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A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.
ISSUED WEEKLY BY THE AMERICAN MACHINIST PRESS,
Vol. 22. 218 WILLIAM STREET, NEW YORK. No. 9

Contents and Index to Advertisers, Page 17.

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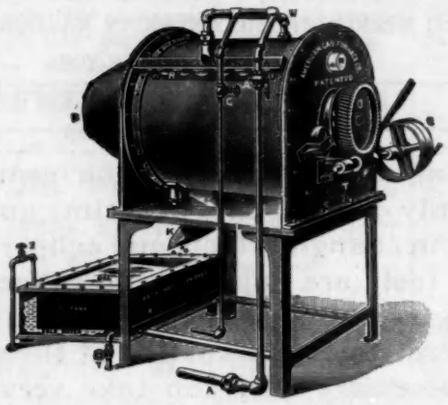

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Index to Advertisers.

	PAGE
Acme Machinery Co	18
Adams Co., The	53
Albro-Clem Elevator Co	51
Almond, T. R	47
Alteneder & Son, Theo	52
American Emery Wheel Works	45
American Gas Furnace Co	2
American Machinery Co	52
American Tool & Machine Co	15
American Tool Works Co	12
Andrew & Co., J. E. H	51
Armstrong Bros. Tool Co	13
Backus Water Motor Co	49
Baird & Co., Henry Carey	49
Baird Machinery Co., U	14
Baker Brothers	49
Baldwin, Davidson & Wight	51
Ball Bearing Co	18
Barnes & Co., W. F. & John	4
Bartlett, Edwin E	53
Beaman & Smith	5
Becker Mfg. Co., John	11
Bement, Miles & Co	44
Berlin Iron Bridge Co	13
Besly & Co., Chas. H	56
Bethlehem Foundry & Machine Co	54
Bethlehem Iron Co	14
Bickford Drill & Tool Co	55
Bignall & Keeler Mfg. Co	49
Bilgram, Hugo	51
Blaisdell & Co., P	10
Bliss Co., E. W	11
Blood, L. H	49
Boston Gear Works	49
Bowsher Co., N. P	4
Box 36	7
Brandywine Machine Works	2
Bradford Belting Co	51
Bradford Mill Co., The	48
Bristol Co	56
Brown & Sharpe Mfg. Co	56
Buckeye Engine Co	49
Buffalo Forge Co	56
Builders' Iron Foundry	2
Bullard Machine Tool Co	14
Burrell & Co., D. H	11
Burt Mfg. Co	40
Carborundum Co., The	13
Card Mfg. Co., S. W	7
Case Mfg. Co	10
C & C Electric Co	8
Chambersburg Engineering Co	54
Cincinnati Machine Tool Co	53
Cincinnati Milling Machine Co	48
Cincinnati Shaper Co	18
Cleveland Gear Works	40
Cleveland Machine Screw Co	4
Cleveland Stone Co	8
Cleveland Twist Drill Co	56
Clough, R. M	7
Coal Handling Machinery Co	54
Cook Co., Asa S	51
Crescent Steel Co	42
Crosby Steam Gage & Valve Co	7
Curtis & Co., Mfg. Co	51
Curtis & Curtis	4
Cushman Chuck Co	9
D'Amour & Littledale Mach. Co	43
Dallett & Co., Thomas H	45
Davis Machine Co., W. P	18
Dayton Globe Iron Works Co	54
Detrick & Harvey Machine Co	10
Diamond Machine Co	4
Dietz, Schumacher & Boye	13
Dixon Crucible Co., Joseph	44
Doan & Co., J. B	6
Draper Machine Tool Co	15
Dreses, Mueller & Co	50
Eames Co., G. T	10
Errington, F. A	9
Evans Friction Cone Co	40
Faneuil Watch Tool Co	56
Fellows Gear Shaper Co	47
Fifield Tool Co	56
Flather & Co	18
Foos Gas Engine Co	54
Foote, Burt & Co	53
Fox Machine Co	18
Frick Co	54
Gang & Co., Wm. E	8
Garvin Machine Co., The	47
General Electric Co., The	52
General Electric Co. (Schenectady)	40
Geometric Drill Co	9
Gisholt Machine Co	1
Gleason Tool Co	56
Goodyear, S. W	4
Gould & Eberhardt	18
Grant Ball Co	51
Grant Gear Works	18
Gray Co., G. A	18
Haeseler Co., C. H	47
Hamilton Machine Tool Co	53
Hampden Corundum Wheel Co	9
Hartford Steam Boiler Insp. & Ins. Co	40
Henderer's Sons, A. L	49
Hendey Machine Co	41
Hill, Clarke & Co. (Boston)	6
Hill, Clarke & Co. (Chicago)	6
Hilles & Jones Co	45
Hobson, Seaman & Co	7
Hoggson & Pettis Mfg. Co	9
Hoppes Mfg. Co	52
Horton & Son Co., E	9
Hunt Co., C. W	47
Hurlbut-Rogers Machine Co	9
Hyatt Roller Bearing Co	2
Ide & Sons, A. L	54
Ingersoll-Sergeant Drill Co	49
International Correspondence Schools	45
Jenkins Brothers	42
Jones & Lamson Machine Co	18
Jones Gage Co	51
Kempsmith Machine Tool Co	4
Keuffel & Esser Co	9
Laird & Lee	51
Landis Tool Co	45
Le Blond Machine Tool Co., R. K	56
Le Count, Wm. G	9
Lodge & Shipley Machine Tool Co	52
Long & Allstatter Co	53
Lucas & Gliem	18
Maris Brothers	2
Marshall & Huschart Machinery Co	6
Mattison, Jas. D	42
McCabe, J. J	6 and 50
Mietz & Weiss	54
Mitts & Merrill	52
Morse Twist Drill & Machine Co	16
Morton Mfg. Co	10
Mossberg & Granville Mfg. Co	51
Newark Machine Tool Works	18
New Era Iron Works	54
New Haven Mfg. Co	16
Newton Machine Tool Works	43
Nicholson File Co	42
Niles Tool Works Co	6
Norton Emery Wheel Co	49
Oesterlein Machine Co., The	18
Palmer Brothers	54
Pearson Machine Co	56
Philadelphia Bourse	2
Phosphor Bronze Smelting Co	40
Pond Machine Tool Co	11
Poole & Son Co., Robt	10
Potter & Johnston Co	55
Powell Planer Co	14
Pratt & Whitney Co	6 and 50
Pratt Chuck Co	8
Prentice Bros. Co	7
Prentiss Tool & Supply Co	6
Putnam Machine Works	18
Q & C Co	13
Quint, A. D	13
Rahn & Mayer	54
Rand Drill Co	54
Reed Co., F. E	49
Reeves Pulley Co	13
Rogers Boat, Gage & Drill Works, John	52
Rue Mfg. Co	54
Sackmann, F. A	51
Safety Emery Wheel Co	53
Saunders' Sons, D	10
Sawyer Tool Co	8
Sebastian Lathe Co	8
Sellers & Co., Inc., William	18
Seneca Falls Mfg. Co	15
Shultz Belting Co	18
Sibley & Ware	45
Silk, Anderson Co	47
Sittman & Pitt	40
Skinner Chuck Co	9
Slocomb & Co., J. T	51
Smith, E. G	14
Smith & Mills	10
Sprague Electric Co	15
Springfield Gas Engine Co	54
Springfield Machine Tool Co	48
Standard Pneumatic Tool Co	45
Standard Tool Co	51
Starrett Co., L. S	3
Steel Ball Co	8
Stevens Arms & Tool Co., J	52
Stiles Press Co., E. S	14
Stover Novelty Works	4
Stuart's Foundry & Machine Works, R. J	56
Syracuse Twist Drill Co	8
Tight Joint Co	53
Toomey, Frank	6
Trump Brothers' Machine Co	9
Turner, Vaughn & Taylor Co	13
United Correspondence Schools	40
United States Metallic Packing Co	47
Walker, O. S	56
Warner & Swasey	56
Watkins Co., F. M	54
Watson-Stillman Co., The	52
Weber Gas & Gasoline Engine Co	54
Webster & Perks Tool Co	53
Webster Co., Warren	54
Webster Mfg. Co	54
Wells Bros. & Co	56
Whitcomb Mfg. Co	13
Whitney, Baxter D	2
Whiton Machine Co., D .E	12
Wiley & Sons, John	42
Wiley & Russell Mfg. Co	53
Williams & Co., J. H	47
Winkley, F. D	47
Wood's Sons, T. B	51
Woodward & Rogers	7
Worcester Machine Screw Co	40
Wyman & Gordon	56
York Co., S. M	8
Young Mfg. Co., W. C	4

Contents.

	PAGE
Some Testimony as to the Value of Technical Education. By Professor C. H. Benjamin	19
A Novel Centering Device	21
A Proposed Testing Machine—Cost of New Battleships. By A. F. Tennille	21
A Belgian Account of a New York Fire	21
Rolling Car Axle Journals	22
A Five-Spindle Drilling Attachment. By A. H. Cleaves	22
Centrifugal Pumps. By W. H. Booth.	24
Annual Report of the Commissioner of Patents	25
The Training of Naval Constructors—The Contrasts of Government and Private Service. By J. E. Johnson, Jr.	26
Extension of the Brown & Sharpe Manufacturing Company's Works.	28
The Piper & Tinker Steam Wagon. By Hugh Dolnar	28
Letters from Practical Men: The Tool Lifter. By Oscar E. Perrigo....Indexing Technical Literature. By S. G....Trying to Locate the Trouble. By "Yeller."....Some Reamer Experience. By W. A. Warman....Overdoing Underselling. By C. W. Pitman....A Novel Mechanical Display for a Public Procession. By Harry E. Thomas....Die Making. By Thos. W. R. McCabe....Machine Photography by Installments. By W. H. Sargent....Marking Holes on the Other Side. By S. E. Freeman....Marking Drills. By Novice....Bolt Heads. By W. Sangster....An External Spacing for Cutting an Internal Gear. By Oscar E. Perrigo....Crank Shaft Steady-Rests. By John Randol	30-35
The Crowding to the Right of Rivers and Railway Trains	35
American Locomotives in England and their cost	36
The Navy Personnel Bill	36
Remove the Naval Officers' Halo	36
Questions and Answers	36
Personal	37
Obituary	37
Inquiry for Machinery	37
Commercial Review	37

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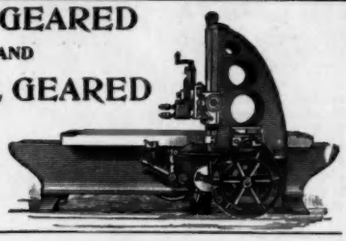

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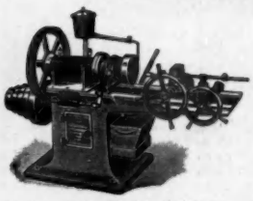

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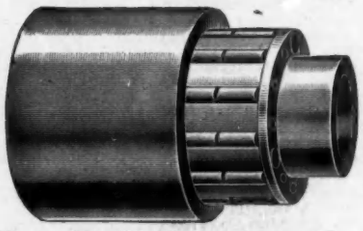

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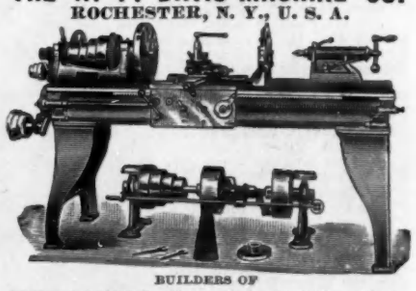

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AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION

VOLUME 22 NEW YORK, THURSDAY, MARCH 2, 1899 NUMBER 9

Some Testimony as to the Value of Technical Education.

BY PROFESSOR C. H. BENJAMIN.

Some of the technical papers of late have contained rather severe criticisms on the work of graduates of engineering schools, claiming that their education had not educated, and that the boy who had grown up in the shop made the better man of the two.

In the writer's somewhat varied experience as workman, engineer and teacher he has not found this to be the case, and suspects that the fault, if any, lies with the kind of man and the kind of education, rather than with education *per se*. He has always remarked the narrowness and shallowness of the boy who has grown up with the shop without further education. Naturally, the man at the head of the shop thinks that boy all right, since the latter is but a reflection or miniature copy of himself.

Perhaps an idea of what the college should do in the way of teaching drawing and shop practice can be best expressed by quoting from a paper which was presented by the writer several years ago before an educational society.*

It is not necessary to discuss the general value of a scientific education in broadening and training the mind.

"One great aim of every such school should be the training and development of the mental powers of its students, and those are the most successful teachers who can teach in such a way as to insure this.

"But, after all, the real object of an engineering college is to supply a certain demand, and the product which it turns out must be such as to satisfy the requirements.

"No doubt technical colleges have in the past created and shaped the demand to some extent, and may continue to do so. In general, however, manufacturers and employers know what they want and will not be moved to change their views by any theoretical considerations.

"The most practical and economical methods in drawing and in manufacturing machinery have been determined by a long course of experience, with its successes and its failures, and from their very nature are not usually susceptible of theoretical demonstration.

. . . . . .

"Instructors who have had actual shop experience outside of school are uniformly more successful in teaching these branches. They should always keep in touch with engineers and manufacturers, that they may understand the requirements of the profession and endeavor to meet them. . . . Following the principles already enunciated, the mechanical drawing should be taught in accordance with the current practice in the best shops in the country. In minor details the usages of various establishments may differ, and it is well for the student to note these differences.

"For this reason it has been my practice to have the student work in the shop from drawings loaned by outside firms, and become familiar with the peculiarities of different draftsmen.

. . . . . .

"In the shop proper the same principle should be carried out.

"The most important branches for the engineer to understand are molding, pattern making, machine work and tool dressing. Joinery should be taught only to the extent necessary to insure accurate work in pattern making.

. . . . . .

"As in the drawing office, the discipline, methods and routine—in fact, the whole atmosphere of the college shop—should be that of a well-ordered modern manufacturing establishment. A good system of accounting for time and stock should be adopted and the men held rigidly to it. The check system should be used for tools, and the men held accountable for their good condition and safe return."

Knowing that graduates from the school with which the writer is connected had given reasonable satisfaction to their employers, I addressed a circular letter to several of the leading firms employing such graduates. The letter read as follows:

"Gentlemen: During the past year there have appeared in some of the leading technical journals rather severe criticisms of the skill and knowledge displayed by graduates of scientific schools, in actual practice.

"Knowing that you have from time to time had in your employ graduates of this school, I ask you to express an opinion in regard to their ability as draftsmen and engineers, and also to make any suggestions as to the better training of such men for practical work.

"Should it seem best, I desire to publish extracts from your reply, omitting names. Yours respectfully."

It is not possible in the space here accorded to give the letters in full, but the extracts will show their general tenor. The letters were all from firms well known in this country, most of them located in the State of Ohio.

A letter from a firm engaged in the manufacture of engines and mining machinery reads in part as follows:

"We have at present in our engineering department six graduates of your school, besides others who have been with us at various times, so that we feel quite well qualified to speak as to the capability of Case School graduates in particular, if not as to graduates of scientific schools at large.

"Some of your men, in fact most of those now in our employ, we value most highly, and from what we have seen of their work, believe that your system of training is about as near the right thing as it is possible to get in any school.

"There is no question but you must have good material to start with, namely, a young man of good habits and quick perception, with the requisite amount of brains to make an engineer, and for this reason, of course, members of the same class may not all develop to the same high degree.

"We believe, however, that you have been successful in impressing the fact upon your men that, while they must be well grounded in theory, this must be continually supplemented by practice and experience to make a successful engineer."

The following letter is from the manager of a large shipbuilding establishment:

"I take great pleasure in replying to your favor of the 12th, and desire to say that so far as the gentlemen we have had in our employ from time to time as draftsmen and engineers are concerned, who have been graduates of schools of science, that we have been very well pleased with them indeed, and that they have given us very good satisfaction.

"In some cases they have not been quite as practical as they might have been at the start, but their training and knowledge have given them a good lead over parties starting in without such knowledge."

The next letter is from the superintendent of one of the largest hydraulic machinery establishments in the country, and is so much to the point that I wish to give it entire.

"My own personal experience as a graduate of a technical school, and also with such as have come to us has been this:

"It would seem as though such were simply fitted out with their equipment or

*Proceedings Soc. Prom. Eng. Ed., Vol. III, page 126

tools with which to work; the art of using them intelligently and practically has to be acquired after they leave school and enter active service.

"Their progress, as a rule, for the first year or two is slow; after that I find they come forward more rapidly than men of equal intelligence who have not had a technical training. A man who is naturally bright and of a mechanical turn of mind, starting at the same time as a technical graduate, will probably net more to his employer during the first two years than the technical graduate of average mind.

"After that period, however, I think the technical graduate has the better of the race, provided, of course, he has been diligent and attentive and applies himself, and particularly is willing to learn the little things.

"Some boys catch right on to an idea, begin taking up details and learning shop ways, language, shop lines of travel, etc., and in the course of a month or two, when given some little thing to attend to, are able to find their own way around without an attendant.

"A boy who does this very soon finds that other matters of perhaps a little greater importance are given to him to take care of. The boy, however, who is waiting to be put in charge of some idea to be carried out, of greater importance, finds when the time comes, if he has not posted himself, that he is not equal to the undertaking.

"I think if the attention of boys who are taking a technical course could be brought to the necessity of learning just these small matters, and also of acquiring a knowledge of the cost of certain fundamental operations in mechanical and other lines, it would greatly assist them.

"The great trouble seems to be that the technical school graduates are without any judgment, and consequently, while they have the ability to calculate results from what they have acquired, they are unable to verify their data, and cannot, when they reach the conclusion, tell whether or not their answer is approximately correct; consequently they do not know whether their premise is wrong, or whether some constant has not been selected with due care and consideration."

The letter which follows, written by the general superintendent of one of our largest electrical manufacturing concerns, shows another side of the question, and will repay careful study by parents as well as teachers.

"During my experience in practical work, I have had no less than three hundred draftsmen and engineers under my direct supervision, and while there has been an occasional talented and reliable man from the technical schools, I firmly believe that the greater portion of our best men are not technical men.

"Understand me; I do not say this in criticism of the school or the professors, for I believe that any shortcomings which a man shows (having had the benefit of a technical education) demonstrate conclusively that he is either untalented or has neglected his own interest, by deriving so little benefit from his exceptional opportunity.

"I believe the men who graduated eight or ten years ago, as a rule, are more reliable, which I attribute to the fact that there were a much less number attending school than at present, and that those who did attend were not given the opportunity unless they showed some talent.

"I believe the middle and wealthy class of parents are somewhat responsible for this, as they will take a boy who should be plowing and send him to a school, using every effort to make an engineer of him. The young man of this stripe almost invariably insists on giving his attention to personal appearance, football, rowing or smoking cigarettes, and then wonders why he does not make a success of life.

"In conclusion I will say that a technical school is all right, that the training is all right, but the fault lies in the selection of the man to receive the education. I believe the pupil should be selected as carefully as an intelligent mechanic would select a piece of tool steel.

"The fault does not lie in the school, but in the man, and I have but little patience with a graduate who does not show good common sense; much prefer draftsmen who have served their time and at the same time developed their own minds under disadvantages."

Most teachers can say amen to this, as they struggle to make silk purses out of (let us say) poor material. Should not the separating of the chaff from the wheat be done before rather than after graduation? Do not the schools of to-day get quantity at the expense of quality?

The next letter is from the superintendent of a well-known firm manufacturing sewing machines and bicycles:

"In reply to your letter of the 8th, we can say that the work of the young men from Case and other scientific schools fully meets our expectations.

"As draftsmen we think they do excellent work, giving proper distribution of materials, graceful lines and good details for the mechanical work.

"Our experience has been that they also show very good judgment in the work of constructing special machines and jigs for the factory.

"It requires only a hint or a few crude marks to make them understand what is wanted. In fact, the whole construction is frequently left to them, and is usually well executed.

"We also find them good men to consult with in new inventions, and we receive from them good suggestions. We are quite sure that men with scientific education combined with practical experience will make by far the better men to take leading positions in our line of work."

In concluding, the following quotations are taken from a letter written by the general superintendent of one of the trunk lines of railroad.

"We have had during the past year in our office of superintendent of motive power, a young man fresh from the Case School of Applied Science, who occupies the position of draftsman and assistant to our mechanical engineers.

"I am assured by the latter that the knowledge of technical matters displayed by this gentleman, coupled with his excellence as a draftsman and his ability to understand and carry out suggestions involving a knowledge of the laws of mechanics, indicates a thorough training, not only in foundation principles, but in practical application of them. * * * *

"From what I have seen generally of the results of the work at Case School of Applied Science, I have been impressed with the idea that the practical application of the theoretical ground work is looked after quite carefully. Very much, of course, depends upon the young man and his inclinations.

"Technical schools in past years have in some cases failed to recognize the bearing which the knowledge of commercial methods may have upon the young man's ability to take care of himself when he first goes into the field in actual practice.

Executive force and knowledge cannot be acquired at a school, but its development can be very much aided by proper training in the direction of self-reliant judgment during the school course.

"It is not to be expected that a young graduate fresh from school would be able to go into a large shop and at once solve all the mechanical problems presented, nor immediately become familiar with the particular shop methods in vogue, but he should be able to properly apply the mechanical principles which have been taught him, and should be so far grounded in actual shop practice as to be able to distinguish between good and bad methods."

Cleveland, Ohio.

Read, Toder & Co., Taganrog, S. E. Russia, who have in their machine shop a number of American machine tools at work are building an extensive addition to their plant, and write us they would be pleased to receive price lists and catalogs from American machine tool builders. They wish to get the most modern and up-to-date machinery.

The fireproof curtain of the Paris Opera House is made of aluminum plates, each about 13 feet long, 39⅜ inches wide and 3-32 inch thick. The exposed area of the curtain is 3,229 square feet, and the curtain weighs 1.8 tons.

A Novel Centering Device.

The ingenious and handy centering tool shown in the cuts is the invention of Mr. M. H. Lockwood, of Missouri State University, Columbia, Mo. The cuts, with added letters of reference, are reproduced from the columns of our esteemed contemporary, "Engineering News."

Fig. 1 shows the device as employed in centering the end of a shaft, the center punch sliding easily in the sleeve of the standard. The mechanically interesting feature of the device is in the means employed for centering the standard before striking the center-punch and making the center. Fig. 2 is a view of the under side

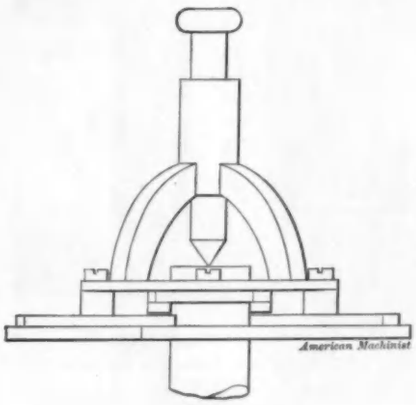


Fig. 1.

A CENTERING TOOL.

of the tool when inverted. The two double-ended levers *O O* are mounted on opposite sides of the ring which forms the base of the tool, and so that they turn freely on their centers, being attached at their ends to the two bars *A B*, keeping

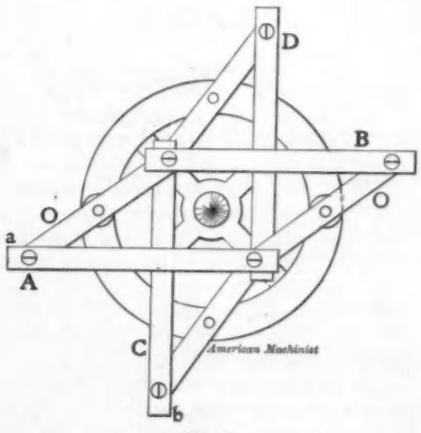


Fig. 2.

THE "WORKS" OF THE CENTERING TOOL.

them always parallel and equi-distant from the center, and causing them to move in and out simultaneously, like an old-fashioned parallel ruler. When the tool is placed over the end of a shaft or other piece to be centered, if the bars are drawn together by the fingers the tool is at once centered in one direction, while the bars *C D*, similarly mounted and operated, and at right angles to *A B*, center the tool transversely. A pressure of the thumb and finger at *a* and *b* opens both pairs of bars. As the two pairs of bars move independently of each other, the device may evidently be used for centering both square and round bars, and also for many other shapes, as hexagon, elliptical, etc. It might be an improvement to apply springs with a constant tendency to draw the bars together. Then it would only be necessary to apply pressure to open the bars, and when released, the springs would at once accomplish the centering. The tool, as made, had a range from 1¾ inches diameter to 0.

A Proposed Testing Machine—Cost of New Battleships.

It has been proposed to purchase a testing machine for tension and compression, at a cost of $250,000, for use at the Rock Island Arsenal, Rock Island, Ill. This machine will be built to give strains of both tension and compression on specimens of all lengths up to 60 feet, and there will be furnished with it its foundations of masonry and metal, the cranes necessary for its use and working, and the pumps and boilers necessary for its general use. An effort will be made to exhibit this machine at the Paris Exposition if it can be completed in time.

Commodore Melville, chief of the Bureau of Steam Engineering, in response to a request from Congress, has submitted a brief statement showing the estimated cost of the fifteen battleships which it is proposed to add to the United States navy, not including the cost of armament. In that report he places the cost of three sea-going sheathed and coppered battleships of about 15,000 tons displacement at $3,600,000 each, or a total of $10,800,000; that of three sheathed and coppered armored cruisers of about 12,000 tons displacement at $4,000,000 each, or a total of $12,000,000; for three sheathed and coppered protected cruisers of about 6,000 tons displacement, the estimated cost each is $2,150,000, or a total of $6,450,000; while for six sheathed and coppered cruisers of about 2,500 tons displacement the individual cost is placed at $1,141,800, making a total of $6,850,800, or a grand total for the fifteen vessels of $36,100,800. An estimate made by Charles O'Neil, chief of the Bureau of Ordnance, as to the cost of armor and armament for the same fifteen vessels was as follows: For the three battleships, 3,100 tons of armor each, at a cost of $400 per ton, $1,240,000 each; main and secondary batteries, $585,000; ammunition and stores, $465,000; or a total of $2,290,000 each. For the three first-class cruisers it is estimated that each cruiser would require 1,400 tons of armor, $560,000; main and secondary batteries, $340,000; ammunition and stores, $400,000, or a total of $1,300,000 each. For the second-class cruisers the amount of armor required would be 70 tons each, or $28,000; the main and secondary batteries would cost $230,000; and the ammunition and stores at $320,000, or a total of $578,000 each. For the third-class cruisers 56 tons of armor would be required at $22,400; the main and secondary batteries would cost $110,000, and the ammunition and stores, $145,000, making the total cost $277,400 each; thus making a total cost for the armor and armament of the fifteen vessels of $14,168,400; this would make the total outlay for the fifteen vessels complete of $50,269,200.

A. F. TENNILLE.

A Belgian Account of a New York Fire.

It is not surprising that foreigners often have pretty wild ideas of America and of the way things are done here, when we consider what their "yellow" journals are capable of.

The following account of the fire in the building in which we were until recently located, is translated by Mr. Buffet from "Le Patriote Illustré," of Brussels, Belgium:

"The insane hight of the constructions that actually are erected in America has necessitated, it appears, the invention of a new apparatus intended to combat the destructive element in the upper stories. This apparatus, arranged with a fire pump, supports as high as the fifth story a hose which, thanks to a special mechanism, may be extended according to the exigencies of the service. It has naturally been necessary to find out just what the new apparatus is worth; and as the Americans are practical people who do not have to consider the question of dollars to give shape to their fancies, they have paid for an experiment unique of its kind.

"According to an agreement concluded between an insurance company which furnished the building, and the city of New York which intervened in the matter of expense, the fire was applied to an edifice of fourteen stories, previously evacuated and emptied.

"Our illustration, executed after 'Leslie's Weekly,' which publishes the reproduction of a photograph, represents the fire.

"The experiment had a double object—to determine the efficacy of the new pump and to demonstrate the necessity of the employment of iron in high constructions instead of wood, which favors too much the propagation of the destructive element. A large piece of wall has fallen from an old portion of the building, but the principal body comprising the fourteen-story edifice has remained upright, and will very quickly be restored to its proper condition."

Rolling Car Axle Journals.

At the January meeting of the Southern and Southwestern Railway Club a committee reported upon the best mode of finishing car axle journals, and strongly recommended the use of the pressure roller for the purpose. The report, which was not long, said, in substance, that axles should be turned on good centers, the journals should be smooth and parallel, and after the turning the surface should be rolled with a hardened steel roller held in a suitable holder secured in the tool post, and the roller then pressed hard upon the surface of the journal as it revolves, with the result of producing a smooth surface, upsetting the iron and closing all the pores or small openings. The process of rolling standard 4¼" axles reduces the diameter but very little and leaves a perfect surface. The cost per journal should not be more than 1 cent if done without putting the axle in the lathe a second time. A sketch of the roller tool is here reproduced. The corners of the roller are rounded to correspond with the fillets at collar and shoulder. This treatment of the journal reduces very much the liability to heat.

A speaker in commenting upon the report spoke approvingly of the use of so wide a roller. Those who originally introduced the process used a roller too narrow and bad results followed, the journal surface having been ridged and "all furred up" by it. Another speaker said that he had, after having much trouble with journals, polished them with emery and oil, thereby much reducing the trouble. The roller process gave better results and was much less expensive. He also made a practice of rolling truck bearings, crank-pins, etc., and was having a tool made for rolling piston rods and air-pump rods.

A Five-Spindle Drilling Attachment.

BY A. H. CLEAVES.

The following attachment to an ordinary upright drill press was suggested by Mr. F. H. Smith, manager of the Chicago Manufacturing & Optical Company, although he does not lay claim to originality in the general character of the device. He gave a general idea of the arrangement wanted, and furnished the valuable feature for gear adjustment shown at *I* and *J*, Fig. 3. I supplemented the details with the end-thrust parts at *L* and *M*, Fig. 3; the drill fasteners *G*, Fig. 3, and the other arrangements. The tool started off all right the first trip and gives good results right along.

In laying the drills out I had to accommodate the same with their gears to the holes already in a jig described in another article. Starting with Fig. 1, *A* is the sleeve of the drill press with its accompanying rack; and *B* is a part of the spindle. *C* is the top-plate to the drilling device, and is arranged to bind on to *A*, having an opening to accommodate the rack. This part is sawed vertically and cross-ways to provide for tightening to *A* by the bolt and nut *E*, Figs. 1 and 2.

The bottom plate *D* is held to *C* by the three bolts *F*, shown in several places. A dust band, not shown in the drawings, holders being more crowded than *H*, Fig. 4. In No. 4 and No. 5, Figs. 3 and 5, the bushing *J* makes the drill spindle bearing. *I* is a lock-nut, and an adjusting space is allowed in *D*. In the same figures and parts, the screw *L* is hardened on the end for the plug *M* driven into No. 4 and also 5, 9 and 11 to press against. *M* is not a

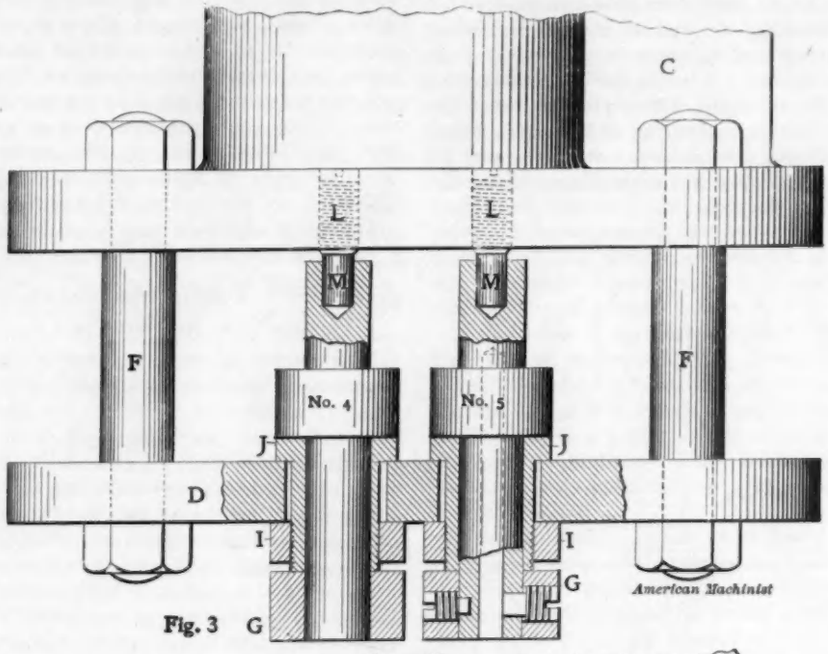


Fig. 3

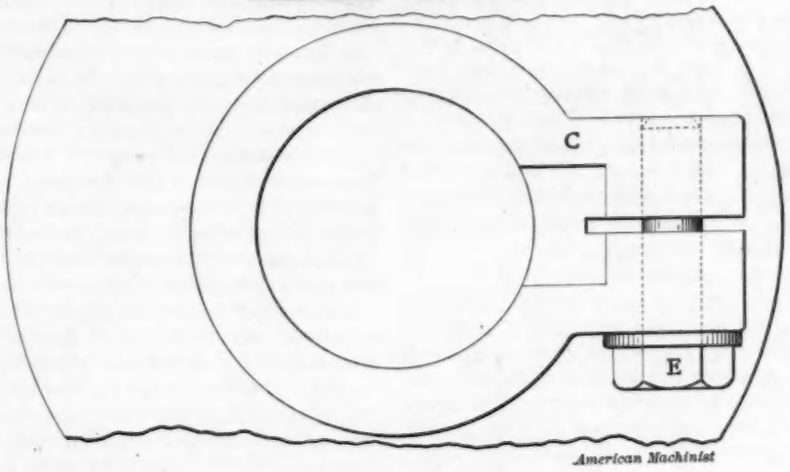


Fig. 2

PART SECTION AND PLAN OF DRILLING FIXTURE.

was used around the whole thing, and can be made and applied in any easy way.

The details severally may be explained as follows: The first gear in the system, designated by No. 1, is held in the spindle *B* by a taper shank, and its lower end holds the largest or ¼-inch drill.

Referring to Fig. 4, *H* is a collar with small set-screw for keeping it in place on No. 1; and a longer one with square head passing freely through No. 1 against the drill to bind it; giving a lot of room for the screw in *H*, as if No. 1 could be solid here.

The same feature is shown as used on the smaller drills at *G*, Fig. 5, these part of *L*. When *I* and *J* are in proper positions they can be secured there more effectively with dowel-pins.

The oiling places, being quite important in this case, were not overlooked. At *N*, Fig. 5, a tube is inserted into the top plate *C* and lets oil into a groove *R* running around the top of No. 4 and having holes *S* letting the oil down further into the open space in the top of *J* onto the running part of No. 4. A similar arrangement is made (but not shown) for oiling No. 12 through No. 1, and 5, 9 and 11 are like 4. The fixed gears Nos. 3, 6, 7, 8 and 10 are oiled as shown at Figs. 6 and 7. A long hole is drilled nearly to the

bottom of the lower pivot, making a reservoir, and cross holes like *p*, Fig. 7, let the oil out onto the bearings. The fixed stud *K*, Fig. 9, for the intermediate gear minute, but as a day's work drilled 350. This was the first day or two of using the tool; and probably piece work would increase this rate somewhat.

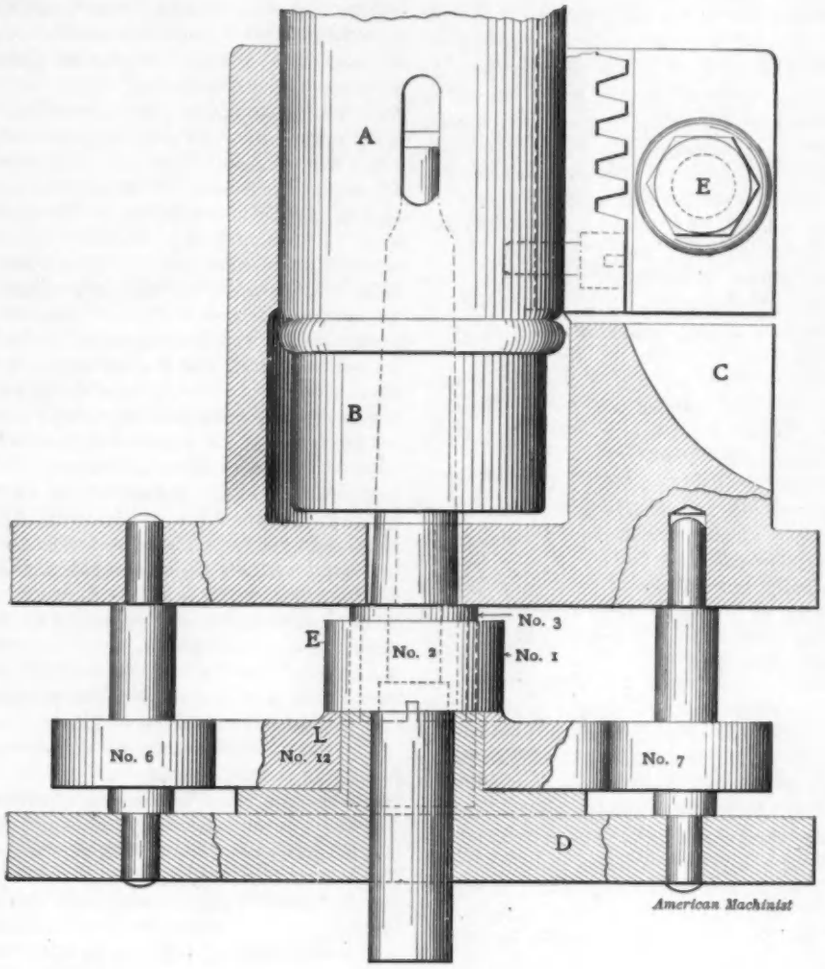


Fig. 1

SECTION OF DRILLING FIXTURE, SHOWING METHOD OF ATTACHMENT.

No. 2, and the end-thrust screws *L* are drilled similarly.

The motion is transmitted from No. 1 to No. 3 through No. 2. No. 3 extends downward and engages with No. 12, which is concentric with the main drill spindle and drives Nos. 4 and 5 directly, and Nos. 9 and 10 through intermediates 6 and 8, 7 and 10, Fig. 11. The ¼-inch drill runs about 700 revolutions per minute, and the others in proportion as geared.

The ¼-inch drill went through 23-32 of stock, the 3-16 drills through 3-16 thick stock above and below, while the 5-32 drills went through ⅜ stock.

The 3-16 drills were used enough longer than the others to drill the upper holes first; and then the four small drills performed, while the ¼-inch was going through the 23-32 stock; as it will be seen that if the drills drilled in succession the same work would be done as drilling one hole at a time in the jig.

A good man used the machine, and put in, drilled and took out one piece in one

The attachment looks symmetrical and is easily handled.

In Fig. 11 a diagram of pitch-line, etc., is given at *U*, and a table of gear requirements is here appended:

Gear.	P	T D′	D	N	D″f
No. 1	32	1.50	1.562	48	.067
" 2	"	.844	.906	27	"
" 3	"	.97	1.031	31	"
" 4	"	"	"	"	"
" 5	"	"	"	"	"
" 6	"	1.31	1.375	42	"
" 7	"	"	"	"	"
" 8	"	.75	.812	24	"
" 9	"	"	"	"	"
" 10	"	"	"	"	"
" 11	"	"	"	"	"
" 12	"	3.19	3.25	102	"

Peoria, Ill.

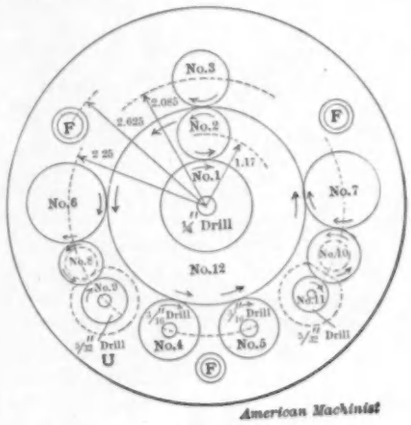


Fig. 11

PLAN, SHOWING ARRANGEMENT OF GEARS.

We learn that Stanley Bros., of Newton, Mass., have contracted with the Mason Regulator Company, of Milton, Mass., for engines for 100 of their steam vehicles, such as were illustrated and described in our issue of December 29, 1898. We are informed that at least eighty of these have already been sold, and this looks as though the manufacture of such vehicles had really assumed some considerable practical importance.

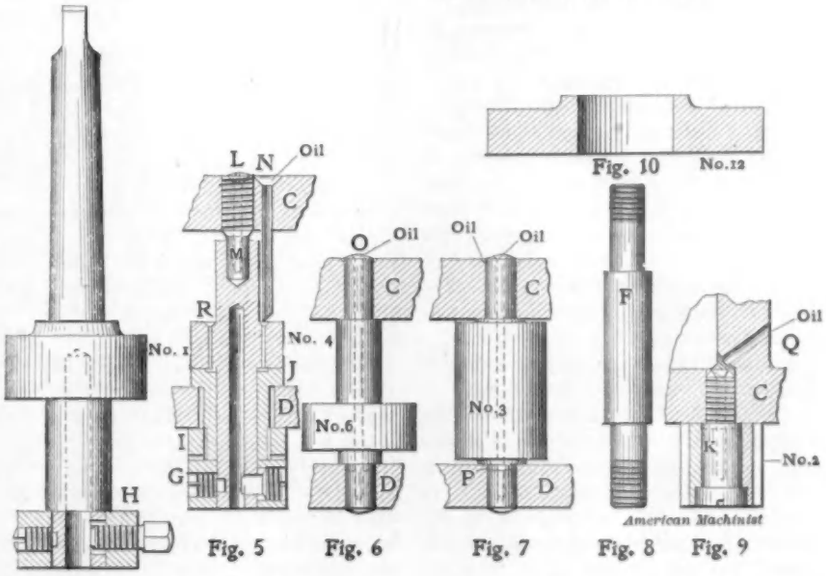


Fig. 4 Fig. 5 Fig. 6 Fig. 7 Fig. 8 Fig. 9

DETAILS OF DRILLING FIXTURE.

Centrifugal Pumps.

BY W. H. BOOTH.

If a power user wishes to purchase a turbine he can very soon find himself provided with any quantity of pictorial literature upon the subject, and will fall into error, if at all, from superabundance of figures and varieties rather than from any paucity. In technical literature, also, he will find numerous treatises upon turbines, more or less suited to his capacity, but usually containing as much confused mathematics as will be good for him.

In a general way it is customary to speak of a centrifugal pump as a reversed turbine. This is only a loose way of speaking; for if we consider, shall we say? the Fourneyron outward-flow type of turbine, it will be beyond our powers to conceive how rotation can be imparted to this wheel in a direction opposite to its rotation as a turbine or power generator and whereby it will become a pump. We might, however, drive the Fourneyron wheel in its normal direction, and then by supplying water at the eye it would become a pump. In the vortex wheel of Thompson, however, which is an inward-flow turbine, there appears a completely reversible wheel, which, driven round in the opposite direction, will become a pump. But a turbine is by no means necessarily convertible into a centrifugal pump.

It is remarkable, however, that in one respect centrifugal pumps are the very opposite of turbines. There is a great dearth of literature on the subject, either technical or for commercial purposes, and it appears that great uncertainty exists in regard to the efficiency of these pumps, their power consumption, speed and other items. In the first place centrifugal pumps are rated by the size of their outlet or inlet pipe. A 5-inch pump is one which has 5 inches diameter suction and discharge pipes, but the diameter of the rotating fan will be probably 15 inches. In two pumps by different makers, I find that while the outlets are respectively 5 inches and 7 inches the fan diameters are 15¼ inches and 18 inches. There is no direct ratio, for $5 \times 18 = 90$, and $7 \times 15\frac{1}{4} = 107$. Nor do they work out on the basis of the square. The ratio is more complex. The pipe diameters vary as the squares of the fan diameters: Thus $5 \times 18^2 = 1{,}620$, and $7 \times 15\frac{1}{4}^2 = 1{,}627$. The diameter of the central eye is about half the fan diameter.

The work of a centrifugal pump is two-fold. In the first place there is the work done in lifting the water from the pit below to the delivery level, and in the second place there is work done in giving kinetic energy, or energy of motion, to the flowing water. The first amount is the net useful effect. In order to obtain this effect it is absolutely necessary that the speed of the periphery of the fan shall be at least a given amount. Let us suppose that the total pumped hight is 36 feet. We know from the accepted rules as to falling bodies that the velocity of flow of water under a given head is eight times the square root of the hight in feet, or $V = 8\sqrt{H}$. For a 36-foot head we find that V must be 8×6, or 48 feet per second. Let us suppose that the pump fan has a diameter of 21 inches. Its circumference will be 66 inches, or 5½ feet. Then $48 \div 5\frac{1}{2}$ is about 9, and this is the theoretical speed of rotation, that is to say, 540 turns per minute. At this rate of rotation the column of water above the pump under a 36-foot head would not run back through the pump; but information is wanting as to how much quicker it is necessary to rotate the fan in order to deliver much water. In practice, I have found fans running at a speed equivalent to double the head of discharge, as to which, more anon.

The second item of work is that of kinetic energy. Knowing the quantity of water which flows through a pump, it is easy to calculate the speed of flow, per second, in the pipes. I have found this as high as 10 feet. Now a velocity of 10 feet per second is too high. By the rule for velocity of flow:

$$V = 10 \text{ feet} = 8\sqrt{h},$$

we find the square root of h must be 1.25 feet, so that h must be about 18¾ inches. In other words, the velocity of flow is what would be given by a head of 18¾ inches. On a lift of 32 feet this apparently trivial amount is nearly 5 per cent. If as the water leaves the pump it is passed through a pipe of gradually increasing diameter, up to, say, double, its velocity of flow will be reduced to one-fourth and the loss of head to one-sixteenth. Thus, theoretically, if we worked all our figures accurately, we should find that we had saved 4½ per cent., having reduced the residual kinetic energy in the water from 4.8 per cent to $\frac{4.8}{16} = 0.3$ per cent., and the water would flow out with very much less eddy and friction. The rest of the work done by the fan is frictional. This we can only modify by careful manufacture and easy bends; but it will always be considerable, for, in both varieties of fan usually employed, there is a large frictional area across which the water flows, and there is more or less production of eddy and some initial shock.

Those who have used centrifugal pumps may have observed that if they have run them gradually up to speed, they will have arrived at a certain speed at which the water was maintained just up to the point of delivery, yet just short of actual discharge. This is where the speed of rotation is just equivalent to the head. At such a time the pump is really working against the head, but, as it is delivering nothing, its efficiency is *nil*. Let a very slight additional speed be given, and it will forthwith pour out its full bore capacity. When lifting, say, 20 feet, an additional speed equal to another foot will determine the difference between no discharge and a very good discharge. The efficiency is thus enormously increased by a very small extra power. If now we run a pump at a sufficient velocity to pump 20,000 gallons per hour, and only allow it to throw 10,000 gallons, by reason of partially opened suction valve, we greatly reduce the efficiency. To obtain the best efficiency there must be no choking or throttling; the fan must run on full gate, and if the pump throws too much water, it is either too large or is run too fast. Where a pump is much too large it may be difficult to slow it down to give the small supply required, because between no delivery at all and a very large delivery, there may be a very small margin of speed. In such cases it is common to work at part gate, and the useless expenditure of fuel or power is very serious. If a pump is too small, it can be run more quickly. This increases the centrifugal action and promotes velocity of inflow of water and causes an increased discharge. There is a limit to this; but the running of a pump faster than the speed necessary to overcome the hight is not necessarily a loss, except so far as eddies and friction are caused, and where the discharge pipes are too small, and there is kinetic loss. The limit to improvement in quantity of discharge is reached when the velocity of flow into the pump attains the maximum due to one atmosphere of pressure, or, theoretically, not quite 48 feet per second. No matter how much faster the fan were to run, it could not draw in water at any higher velocity, because it could not produce more than a perfect vacuum.

The greatest suction I have ever found accomplished by a centrifugal pump was fully 30 feet, and I could scarcely credit the figure, for it seemed too good. At that suction a 5-inch pump with 15¼-inch fan discharged about 20,000 gallons per hour. Now, I have found pumps speeded for low lifts at a very much higher velocity than necessary to produce the maximum inflow, and, such being the case, it appears probable that there must be loss of efficiency. Thus, suppose a pump is required to lift 24 feet above itself, and it is speeded to the equivalent of 48 feet. Let us suppose, as is often the case, that its supply flows to it. The pump is endeavoring to draw water at a velocity equal to a fall of 48 feet, or 53½ feet per second. But it cannot receive water more quickly than about 48 feet, or that velocity per second due to one atmosphere, or 34 feet of water. Practically 44 feet velocity would be a maximum. Is not this pump exerting a useless endeavor of 48 feet — 34 feet, say 14 feet, more than needful? It is trying to draw water at a velocity beyond the possible and is running too fast. This seems to be a point which has been overlooked, and it may be the reason why

efficiency is often so much lower than perhaps might be anticipated, for it implies suction pipes too large in diameter and a sudden shock when the water enters the more quickly moving fan.

Some writers state that with a peripheral speed of fan the water discharged by a pump will rise to a hight double the fall which would be required to give the same velocity of flow. Thus, if water falls freely a hight of 16 feet, it acquires a velocity of 32 feet per second; but if the fan gives to water a velocity of 32 feet per second, it will force it to a hight of 32 feet, or twice 16 feet. The idea does not seem correct, nor does it appear to be borne out in practice. Thus a body of water may start at a velocity of *nil* and finish at, say, 10 feet per second; but if it starts at 10 feet per second, it will flow upwards just twice as high as it fell to gain the velocity 10. Of course, the water may leave the fan at an actual velocity greater than the fan, because it has a tangential velocity equal to the fan speed and a radial component in addition, the resultant velocity being combined from the two; and as the velocity is given by the fan, this must have given to the water a corresponding store of energy. But this energy cannot be recovered except by means of a very large whirlpool chamber outside the fan. In practice, this is never done, but a compromise is effected by a small diffusor and a gradually increasing spiral casing.

As a rule, the supply enters a pump at a somewhat sharp angle, and it is required to suddenly acquire a whirling velocity equal to that of the inner ends of the fan blades. To improve the efficiency of the pump, it would appear rational to compel the approach to take place in a direction parallel with the spindle and inside a tube which commences at a large diameter in the supply pit and diminishes towards the fan, into which it should be admitted by an easily curved mouthpiece, while the inside of the pipe should be ribbed in a spiral of such gradually increasing twist as to confer upon the water a spiral motion approaching that of the inner eye. The ribs, which ought to be thin, should also die away before they reach their maximum twist, and at some distance before the casing is reached; for the whirl they have given will be increased by induction from the fan backwards, and will be more free and correct than if the quick rifling were continued up to the fan eye. I am not aware that this initial whirl has ever been attempted or suggested, but it seems to be the natural corrollary of the guide blades in the turbine. The practical difficulty of the system lies in the necessity of driving the pump, which would be difficult, excepting with a supply pipe to one side only. Speaking generally, it may be said that for best efficiency a centrifugal pump must work with full gate; it must not run faster than the supply pipe will allow natural flow, whence it follows that the suction depth should not be needlessly great. Where the suction depth is considerable it is probable that the supply pipe should be large, and possibly the eye of the wheel should be larger than usual, and something would need to be sacrificed by reason of the shock at entry of slow-moving water to a quick wheel. It is probable that the hight of about 20 to 30 feet, at which centrifugal pumps work best, is due to the fact that this represents about the usual head of flow into the casing, and the areas of passages and pipes can be proportioned uniformly throughout.

The flow being continuous, it is not usual to provide an air vessel, but it is possible that the provision of an air vessel might be advantageous. To return, however, to the question of hight. In passing through a pump the water is given a centrifugal travel which enables it to exert a pressure and rise in the discharge pipe. It also acquires velocity of flow tangentially. To check this latter the pump vanes are curved backwards, like the blades of a turbine, and the water, for the best effect, should perhaps drop out of the wheel with radial motion only. To do this, however, the pump would lose its delivery power; for the recurving of the blades would throttle the discharge, and very much recurving is not done. With radial vanes and a suitable chamber for the water to form a free vortex, the hight pumped may be made greater than that due simply to velocity, for both pressure action and peripheral speed unite to give a greater head. It is this combined action which is intended by some writers, but it is difficult to secure fully with moderate sizes of construction.

It is a curious property of this compound action, that, while a pump must be run at a certain minimum velocity before it will deliver water, yet, when once it begins to discharge, flow is very rapid and will continue after the pump has been slowed down considerably below the minimum speed at which it will begin to work. This property is not of much use in practice, because the pump must always have an initial speed sufficient to start the flow, and cannot afterwards always be conveniently slowed down. It occurs to me, however, that if the pump be run at very little above its minimum necessary speed it could be made to start at that speed by providing it with a bypass discharge gate, which would allow the discharge to take place at half the working head, and then might be slowly closed, whereby the full head would be attained. The closing might be automatic.

With pumps large enough to have a properly proportioned vortex chamber, the outer ends of the vanes might be made radial. They are so made in the Thompson vortex turbine, which is one of the few turbines that may be reversed as a pump. In the turbine, guide blades are used to direct the water upon the wheel, but their utility is doubtful in the pump, excepting in the supply pipe, to which partial helical guide blades seem desirable to set the water into a whirl so that it may enter the eye of the fan without shock. If complete whirl could be established a centrifugal pump need only have radial vanes, or vanes very little removed from the radial direction.

Annual Report of the Commissioner of Patents.

The report of the Commissioner of Patents, Charles H. Duell, for 1898 has just appeared. There were received for the year 33,915 applications for patents, 1,843 for designs, 84 for reissues. There were 22,207 patents granted, including designs. The number of patents expired was 15,548. The number of allowed applications which were forfeited for nonpayment of the final fees was 4,363. The receipts of the office over expenditures were $1,538.28. The balance to the credit of the Patent Office in the Treasury of the United States is $4,972,976.34.

The Commisioner asks for additional room and for an increased force in the classification division, also for additional stenographers and typewriters. The annual appropriation for the scientific library has for years been inadequate. Authority is asked for selling books in the library not necessary for the work of the office.

The following amendments to the patent and trade-mark laws are recommended:

1. Providing for a Commissioner and Assistant Commissioner for a stated term, not less than six years. There have been since 1870 fourteen Commissioners.

2. To limit the life of all patents to twenty years from the filing of the application. At present it is possible to keep applications alive for an indefinite number of years.

3. Permitting aliens to file caveats. This is recommended for the sake of probable concessions from foreign countries.

4. For the publication of 3,000 additional copies of the Patent Office Gazette, to be apportioned among Senators and Representatives, to be distributed among manufacturers and mechanics. It is notorious that those officials have peculiar facilities for placing them where they will do the most good.

5. To provide for the registration of trade-marks used in interstate commerce.

6. Providing a fee of five dollars for petitions in interlocutory proceedings.

The concluding words of the report embracing a general plea for the Patent Office and the American inventor, we reproduce in full:

"When it is remembered that this office is more than self-sustaining and that American inventive genius has cheapened the cost of production to the advantage of American wages, it seems as though the legislative branch of the Government

has done very little to encourage the useful arts and the inventors of the country. At the present time, when our manufacturers are reaching out for foreign markets, I believe no greater aid can be given them than by fostering and stimulating invention. The United States can only become dominant in the markets of the world through labor-saving inventions which will enable it to compete with the lower wages paid to the so-called working classes in other countries. The greatest development in American exports must be in the direction of increase in the export of manufactures. I assert, without fear of successful contradiction, that we mainly owe to our patent system such foothold as we have gained during the past fifty years in foreign lands for our manufactured products. We can, by a fair and liberal treatment of our inventors, control for our manufacturers not only our home markets but the markets of the world. In the words of a recognized authority, 'In labor-saving machinery and in the intelligence of the labor employed, the United States to-day is in advance of the world.' Most labor-saving machinery perfected within the last seventy-five years is the invention of our own people. The reaping machine, which from 1861 to 1865 did the work of more than a million men with hand implements, is of American origin. The same is true of the modern plow and its added improvements, of the corn planter, and the threshing and separator machines. In the textile industry the American record surpasses that of all other countries. Wool-carding machinery owes its chief improvement to the invention of John Goulding, whose patent was issued in 1826, which dispensed with the splicing-billy, and produced the endless roll or sliver. The Crompton loom for weaving fancy woolens and the Bigelow loom for weaving carpets are of American invention. It is not alone by fundamental inventions that our inventors have revolutionized in so many respects the textile industry. Not the less have their inventions in automatic devices, in expediting processes, and in many steps dispensing with hand labor assisted in placing this country in the front ranks in the textile art. Another marked illustration is found in the steel industry, where the reduction in manual labor has enabled our manufacturers to successfully compete with foreign nations. American electrical appliances command the world's markets. This subject is somewhat trite, and I have only referred to a few well-known historic facts for the purpose of emphasizing the advantages that will certainly flow from recognizing the just claims of our inventors. Let us not forget that it is the American inventors who by their inventions and discoveries 'have made the last fifty years of the nineteenth century the most remarkable of recorded time' and at the same time have laid the civilized world under tribute to American manufactures.

"In return for all this our inventors only ask a fair field and fair treatment. They only ask that the money paid into the Treasury by them shall be used, so far as necessary, for the purpose of providing necessary facilities for prompt and intelligent action upon their applications for patents for their inventions. They ask no subsidies. They give more than they take. An enlightened public sentiment demands that their requests should be considered with favor by the Congress of the United States."

The Training of Naval Constructors—The Contrasts of Government and Private Service.

J. E. JOHNSON, JR.

There appeared in the "American Machinist," a few weeks ago, an editorial concerning the assistant naval constructors and from whence additional ones needed by our increased naval establishment should come, especially since (as therein explained) the foreign schools of naval architecture, particularly those in England and Scotland conducted by the British Government, have ceased to allow our cadet naval constructors to take their two years' course (after graduation at Annapolis) with them.

The editor rather disparages the two years' course after graduation, as an additional and unnecessary overload of mathematics on top of a course already too well filled with that subject (the words are mine, but I think the idea is nearly correctly quoted).

He proposes, as a simple way out of the difficulty, to appoint young assistant engineers and ensigns, who have had actual experience with the ways of ships and their needs, to fill the vacancies in the constructors' corps. It is upon this proposition and the very interesting subject which the editorial brings up that I propose to make a few comments, based on interested, if limited, observation and reflection.

In the first place, it is probable that we have not lost as much by the closing of the foreign naval schools to our cadet constructors as most of us have been in the habit of thinking, for it has been a regular thing for the American students at those schools to take the first prizes. This has not happened a few times, at one school or another, but every year. This means one of two things—either that Americans are always, and without exception, smarter than English or Scotchmen in the same profession, which I hope no one is idiotic enough to believe; or that the Americans are so far advanced in their studies when they go to those schools that it is easy for them to keep ahead of the others. That the latter is the more probable reason is further shown by the fact that the Annapolis boys did not have to work at all hard during their two years' foreign course—in fact, not nearly hard enough. This shows, I think, that their studies at Annapolis must, to a considerable extent, cover the same ground as those at the foreign schools, and that to be cut off from the latter is no insuperable obstacle to attaining the knowledge that a naval constructor needs.

This brings us to the difficult question as to what that knowledge is. The editorial mentioned above assumes, by implication, that the regular Naval Academy course of four years, supplemented by a few years at sea as an engineer or line officer, is sufficient, and there I think lies a fundamental error.

We shall all admit readily enough, I think, that naval construction is a branch of engineering, pure and simple, more or less specialized in certain directions, but engineering none the less. Then the Annapolis graduate previous to his sea experience would claim fitness, we might say, solely on the ground of being an embryo engineer.

Without having compared the curricula of the two institutions, I feel safe in saying that, as an engineer, the Annapolis graduate is certainly not the superior of, let us say, a Cornell graduate, in point of preparation at entrance and theoretical and practical work done during his course; yet would anyone claim that a few years at sea as a naval officer would make a naval constructor of a Cornell or other technical graduate?

It may be answered that he would have to pursue studies in the direction of naval architecture after graduation, and so would the Annapolis man, to fit them for the place; but, up to now, at least, this has not been the case. The line officers after graduation study in the direction in which their own duties will be—ordnance, torpedoes, international law, etc.; the engineers study the things which tend to increase their professional efficiency in their own line in the same way.

It is doubtful whether a dozen men could be found in the lowest commissioned rank of the entire naval service, ensigns or engineers, who would be considered by the general manager of a private shipyard competent to fulfill the duties which fall to an assistant naval constructor at a navy yard. It would, in fact, be surprising if *one* could be. This is not said in any disparagement of these officers; on the contrary, they are deserving of praise for what they do know and their efficiency in their own lines.

But, while, as before stated, engineering is at the base of naval construction, it would be preposterous to expect that in a four years' course a student, either at Annapolis or elsewhere, should acquire a thorough grounding in the general principles and practice of engineering, and in addition should obtain more than a smattering of the additional mass of practical and theoretical knowledge which is

necessary for the intelligent construction of ships, especially those for naval purposes.

Consider the intricate relations which exist between the size, lines and power of a ship and its speed in smooth water, let alone in rough; its displacement and center of gravity and its coefficient of steadiness and innumerable other relations. Then think of the vast mass of practical details in the construction of a ship, once its design is made; the methods of forming and fastening the different parts, and the knowledge of these things which *ought* to be possessed by the designer before he begins his work.

It is with the idea of giving some part of the first kind of knowledge mentioned that the two years' additional course has been required for naval constructors hitherto, and in view of the facts there is certainly much to recommend it. If it is largely mathematical, it is because the various relationships involved are quantitative and follow laws whose mathematical expression is complex; and no way is apparent of avoiding a knowledge of these laws and the concomitant mathematics, if the work of the naval constructors is to be done as it should be.

When it comes to the proper acquisition of the other kind of knowledge, more difficult to obtain and more indispensable than the first—the knowledge of the methods and details of the actual work of construction, it seems impossible that the constructors of the navy will ever possess it to the same extent and with the thoroughness of similar officers in private enterprises.

There are several reasons for this. In the first place, economy is not as much of an object to the government as it is to private concerns, and therefore there is not the same pressure on the officers of navy yards as there is on those of private ones.

Another point is, that the incumbents in the navy are chosen by their standing in studies, conduct, etc., in their youth, and granting that this system gets the pick of the men as regards brains, which is not necessarily the case, even that is a long way from insuring a man's absolute fitness for a given position in his maturer years, by which such officers are generally chosen in private works.

Further than this again is the fact that when a works of any description is run or controlled from a distant bureau (sometimes thousands of miles distant), the time and attention of the responsible officer on the ground must be largely taken up with what may without undue disrespect be called the red-tape of the bureaucracy, and to a corresponding extent diverted from the execution of the work itself.

Perhaps the chief factor of all, however, is that when a man in civil life holds such a position as corresponds to either naval constructor or assistant naval constructor, it is practically a guarantee that of the practical part of the work—the knowing how to do it, and do it well, quickly and cheaply—he knows all the ins and outs thoroughly, probably by having done a good many of the different kinds of actual manual work himself for a greater or less number of months or years.

This training it is practically impossible for the naval constructor to get, for there is no place for it to come in. It is difficult to see how it would be possible for the government to so arrange things that, after graduation, a cadet constructor should be obliged to go to a shipyard, preferably a non-government one, and there sink all idea that he was a naval officer in embryo and do the hard and sometimes disagreeable work that falls to the lot of the ordinary apprentice or laborer until he became competent to be a mechanic; and as a general proposition, there is no other way to get the kind of knowledge necessary.

That I am not overstating the truth in this matter is proven, in part at least, by the fact that Mr. Lewis Nixon, certainly the most prominent shipbuilder of his age in the country, and one whose success has been remarkable, having completed his course at the Naval Academy and his two years' additional course as a naval constructor, resigned from the navy to follow his profession in private life; and, as the initial step, took three years at the Cramp shipyard at actual manual work—not drafting or clerical duty, but just plain, ordinary, everyday *work*.

As before stated, however, it is not easy to see how the government could train its naval constructors in this or a similar way; and if it did, it probably could not hold them at the present rates of pay, for the good ones would be worth far more in private life, and would get it.

To a certain extent the editorial suggestion above quoted would tend to supply this want, but only to a limited extent, for the building of a ship is not very closely allied to the management of its crew, which is the principal duty of the line officers, though the latter undoubtedly learn much that it would be of use to a naval constructor to know.

In this respect the engineers have an advantage, because the operation of engines is very closely allied to their design and construction; so that an engineer at sea is learning the very things that he needs to know in his shore duties, the two kinds of service thus each helping the other; and this fact may be partially responsible for the magnificent record which the engineer corps has made for itself, not only in its conduct at sea, but in the design of new machinery, etc. Before closing I wish to go back for a moment to my former assertion (by implication) that the government *must* be poorly served in many respects, because it must choose between the two horns of a dilemma—either the spoils system must be in vogue, or else civil service reform. If the former, then one man or group of men have the appointing power at a navy yard (and other places, too, but we had better confine ourselves to our original subject); generally one man is supreme in each department and can hire or discharge anyone he sees fit, at will.

If he is a good man, wholly disinterested, and deaf to the blandishments and threats of eternally ravenous politicians, and knows his business thoroughly, he appoints good men as mechanics, etc., because they are good, and likewise discharges bad ones. He buys the best tools because they are the best, at whatever may be their market price, and runs the establishment on business principles, generally.

If he is the opposite kind of a man, he hires men who can swing voters into line for this or that Congressman, or who are brothers-in-law to an old friend of a Senator of the dominant party; buys tools of a personally agreeable salesman, irrespective of whether they will produce a pound of chips per hour or per minute; or perhaps of the one who gives him the largest commission; though, to the honor of the navy be it said, cases of the latter kind have been very exceptional.

This should all have been put in the past tense, for really neither of the conditions described is possible to-day, and instead we have civil-service reform in which men who desire employment are required to register their names and addresses at the yard, with the kind of employment they want, and when help is needed they are taken from the list of the kind wanted in the order of registration. Some attempt is made to prove their fitness or the reverse; and, once employed, while they may be discharged, it is not to be done with the ease and simplicity of a private works where the foreman simply "fires" a worthless man because he is worthless and because the foreman is paid, among other things, to know and fire that kind.

This system prevents favoritism under the second kind of officer, but it also ensures the first kind a reasonably inefficient set of men to work with.

So, also, when tools or other material are wanted, they must be requisitioned for, generally on the Bureau at Washington, or bids sent out subject to the approval of the Bureau. This pretty well prevents corruption of any kind, and very likely insures that, in the matter of tools, for instance, a poor one will be gotten because it can be built and sold cheaper than a good one, though conforming to the same general description.

Last summer, to the knowledge of the writer, a specification for obtaining bids on planers at a certain yard was returned from Washington as too restricted, because it specified the Sellers helical-rack drive. Those present counted up five of the firms building planers who used that style of drive, including those of the highest reputation in the country. I don't

know how many more there are. If a superintendent of a private shop had a specification for bids turned down on that ground and under those circumstances, wouldn't there be a howl?

Other things might be told, but there is no need. It seems likely that the government will be served inefficiently as long as human nature is what it is, and the best work will be done, through our time and beyond, by those who love the work and are *fighting for their own hand*, reaping the reward that they themselves have earned. As to how we are to get our naval constructors it is impossible to say at present; certainly they must be specially trained in both theory and practice, if it be possible; in theory alone, if that alone is possible. Perhaps in the passage of the Personnel Bill, which seems so probable now, a solution will be opened up; for the necessary result of its passage will be, sooner or later, the reconstruction of the curriculum of the Naval Academy on a basis of more engineering studies, and this may be extended later to cover the case of the constructors also.

If the present system has produced such excellent results, we can afford to hope for the best from the future, with a system obviously so much better and more just.

Longdale, Va., January 14.

Extension of the Brown & Sharpe Mfg. Co.'s Works.

The Brown & Sharpe Manufacturing Company will add two stories to the present blacksmith shop, the two floors having an aggregate area of 15,000 square feet. The top floor is to contain a new drawing office, in which Mr. Burlingame will carry out his ideas of the arrangement and equipment of a model drawing office. The remaining space will be used as a machine shop. Work on the extension will be begun about April 1.

The Piper & Tinker Steam Wagon.

Piper & Tinker began the construction of steam road vehicles in 1895 and have built, up to date, three wagons, the second of which was sold to Mr. Thornton, of Philadelphia. The Thornton wagon had a water-tube boiler; wire spoke suspension wheels, 28 and 30 inches diameter; Newton tires, 1⅞ diameter in front and 2 inches diameter in rear; air pressure, 90 pounds; wheel gage, 48 inches; wheel base, 60 inches; total weight of vehicle, 900 pounds. The engines were a pair of cylinders, 2½-inch bore by 3-inch stroke, slide valves, with eccentrics and links, and a steam diaphragm fire regulator, with a pop safety valve set to 165 pounds, the steam pressure as fixed by the diaphragm regulator being 160 pounds. The weight of the water-tube boiler was 110 pounds, empty; hydraulic test, 500 pounds per square inch. Chain reduction from engine shaft to compensating gear disk, 4 to 1. The wagon from which these pictures were taken was built in 1898 and has the same wheel diameters and engines and gear reduction as the Thornton wagon. The tires in the present wagon are "Kangaroos," 1⅞ and 2 inches diameter. The gage and wheel base are the same as before, 48 and 60 inches. The total weight of this last wagon is, however, reduced to 700 pounds. The boiler weighs 100 pounds, has a heating surface of 65 square feet, and holds four gallons of water.

The Piper & Tinker boiler is made up of vertical members 1⅛ inches in diameter, with 1¾-inch head and foot tubes, twelve uprights in a section, and nine sections, making in all 108 vertical tubes; all sections connected by side pipes, 1¾ inches diameter; the vertical tubes each contain an internal flue, ½ inch in diameter by about 21½ inches long, this flue running straight through the head and foot, takes the sections. No drawings were available and no photograph of the boiler could be obtained. The tubes and flues are all made of No. 20 B. & S. gage copper, brazed together. This boiler is fired by ten burner tubes, placed horizontally under the boiler. These burner tubes are closed at one end and have each an independent screw-adjusted ratchet and pawl-retained needle valve, which governs the admission of fluid gasoline to each burner tube, all as shown in Fig. 4, in which the firebox cover is removed. The short horizontal tubes, open in front, shown in Fig. 4, are air tubes, supplying air to the burners; they lie close alongside the burners, and are drilled with many small holes to distribute the air equally to them. The burner tubes are drilled along their top semi-circumference, with holes 1-64 inch in diameter, spaced ½ inch center to center, and staggered. These burner tubes are, of course, hot when in action, and the fluid gasoline when admitted through the needle valves into the burner tubes falls to the bottom of the tubes, which are not perforated, and is there vaporized, and then rises up through the small holes in the top parts of the burner tubes and burns under and among the water tubes of the boiler.

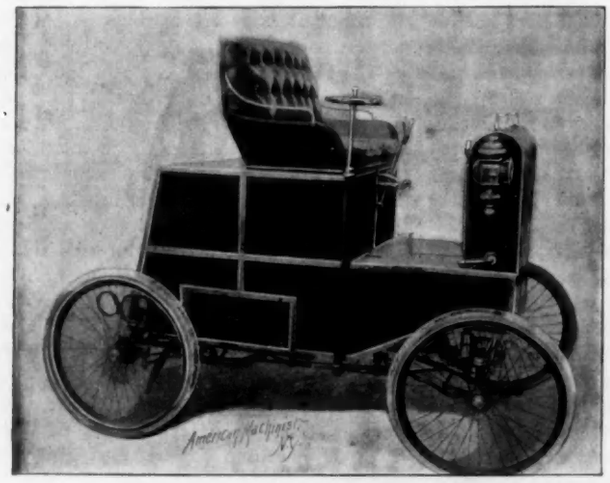


FIG. 1. PIPER & TINKER STEAM WAGON.

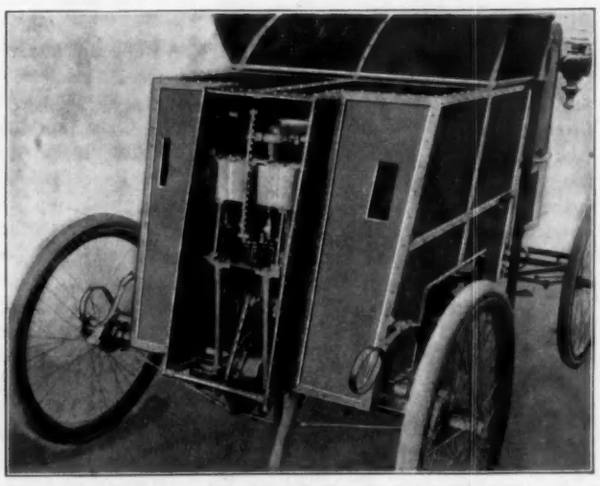


FIG. 2. PIPER & TINKER STEAM WAGON, SHOWING THE ENGINE.

It should be borne in mind by all makers of gasoline-fired boilers, that if any fluid gasoline can possibly run into the burners and become ignited when in a fluid condition, this condition is sure to occur some time, and any attempt to light the fire will then result in a conflagration quite likely to burn the wagon up completely. This has already occurred.

This Piper & Tinker burner did not, when I saw the wagon fired, effect so perfect a combustion as to prevent a very strong odor, although Mr. Piper said that when the burners were in good order no smell could be perceived. The pipe which supplies all these burners with fluid gasoline is interrupted by a needle valve, which is under control of a steam diaphragm, and so controls the admission of fluid

gasoline to the burner tubes by the steam pressure. There are also two air openings just above the burner tubes, controlled by swinging dampers, as shown in Fig. 4. The products of combustion, I think, pass out of the rectangular openings shown in the rear end of the wagon body in Fig. 2. The exhaust is downward through the rubber hose, *H*, Figs. 1 and 2. This exhaust hose is carried down very close to the road surface. Mr. Piper said that he considered his boiler and burners perfectly satisfactory when in good order, but that the burner tubes were not in good condition when I saw them.

The Piper & Tinker engines are enclosed in a vertical trunk at the extreme rear of the vehicle, and the engine shaft is located over the rear axle. The rear axle carries the compensating gear, and the speed reduction is made by a six-tooth sprocket on the engine shaft, which takes a short vertical chain leading to a twenty-four-tooth sprocket on the compensating gear disk; all as quite clearly shown in Fig. 2. The weight of the engines was given as 50 pounds.

The body springs, shown in Fig. 2, are very peculiar, being made of a single piece of flat steel, clipped at the middle point to the wagon body, as shown, then bent downward on each side of the clip, and then given a complete turn at each end, so bringing the ends of the spring together in the middle, where they are bolted to clips secured to the tube in which the axle runs. This unique spring seemed sufficiently elastic, and Mr. Piper said it was cheap and gave no trouble.

The seat is placed very high, as is needful to accommodate the long vertical boiler tubes and the burners below them. The dash-board is very much thickened to enable it to serve as a water tank. The peculiar appearance of the wagon body is due to the use of aluminum plates instead of wood in its construction. These body plates are in sections, enamelled black, the retaining strips being nickel-plated, and the whole supported on a steel framework. This is said to produce a very light construction.

Fig. 1 shows the general arrangement of the steering wheel, which is placed at the top end of a vertical shaft at the right end of the seat, pressure gages, engine-controlling levers, brake treadle, and so on. The steering shaft has a very small pinion on its lower end, which meshes with a very narrow-faced rack, this rack being pivoted at its forward end to one arm of a bell crank. To the other arm of this bell crank the connecting rods which lead to the wheel hub arms are pivoted. This whole steering rig looks very light and feels decidedly "springy" when moved to turn the wheels.

The links are shifted by the usual latched lever and notched quadrant, as shown in Fig. 1. The steam gage is just in the rear of the lever stand, supported on an inclined steam pipe leading forward and upward from the boiler. The sliding bar seen immediately in front of the lever stand operates the throttle valve; this bar is to be supplied with a vertical hand lever to operate it. The brake is operated by the vertical treadle seen standing up above the foot-board.

The gage seen on the inside of the dash-board shows the air pressure, maintained by a hand pump, in the gasoline tank, which is carried in the dash-board, either beside or below the water tank. The gasoline tank holds 7 gallons of fuel, and carries an air pressure of 10 or 12 pounds. The water tank holds 17 gallons. This makes about 181 pounds of fluids carried by the wagon when filled for a journey, and with two passengers brings the total weight of the vehicle on the road up to 1,181 pounds, say 1,200 pounds. Mr. Piper said the wagon, two passengers up, would use about 17 gallons of water and 3 gallons of gasoline in a run of 25 miles.

The brakes are a pair of band brakes, one on each driving-wheel hub, as pretty well shown in Fig. 2. These brakes are worked through an equalizing lever, so as to give an equal resistance.

The compensating gear has four bevel pinions, and is of usual construction.

Fig. 3 is a view under the foot-board, close in front of the boiler casing, and shows the gravity boiler feed used by Piper & Tinker. The origin of this form of boiler feed is not known to me; it has been familiar to me for forty years at least, and I think it was an original invention of my own, though I never believed myself the first to conceive the general idea embodied in this form of boiler feeder. Several writers have mentioned the gravity feed lately in the "American Machinist," none of whom speak of it as existing in working form, and this example in the Piper & Tinker wagon is the first instance of its actual use that has ever come under my notice.

In Fig. 3 *R R* is a horizontal, closed cylindrical water receiver, set at such a hight that the top line is in the plane of the high water level in the boiler. This closed receiver *R* communicates with the water tank through the hose *T*, and with the boiler by top and bottom pipes *P*, the top one only being shown. All three of the receiver communications are controlled by valves, and these valves are all operated from a slow cam operated directly from the engine shaft; this cam closing the water admission to *R* when the two valves in the two short angle pipe *P* are opened to the boiler, and *vice versa*. Supposing both the top and bottom communications between the receiver and the boiler are closed, then the communication between the receiver and the water tank is opened, and the receiver will fill with water almost instantly. Then the cam action closes the water-tank communication and opens the top and bottom boiler communications. If the water level in the boiler is below the top line of the receiver, some water will run into the boiler; if the water level in the boiler is enough below the bottom line of the receiver, all of the water in the

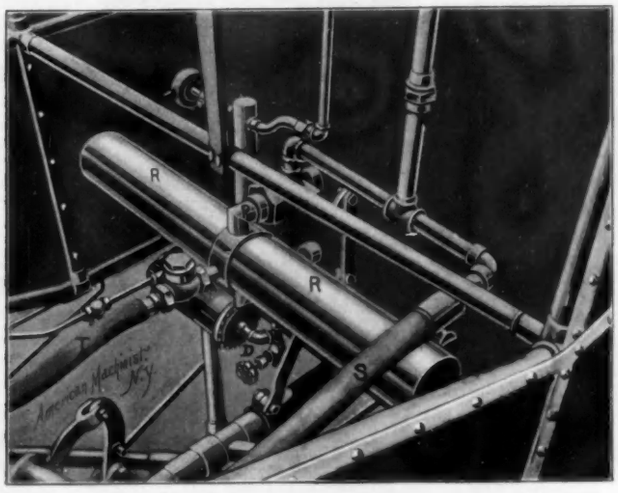


FIG. 3. PIPER & TINKER GRAVITY BOILER-FEED.

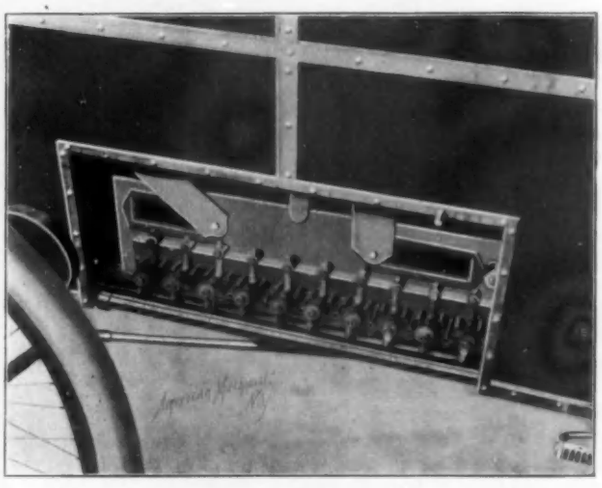


FIG. 4. PIPER & TINKER BURNER REGULATING MECHANISM.

receiver will run into the boiler; if the water level in the boiler is as high as the top line of the receiver, then nothing happens; the water in the receiver simply stays where it is, and the whole feed becomes inoperative. This evidently makes a peculiarly suitable feed for a boiler which is to be automatically governed, as the boiler cannot possibly be flooded; and if the valves are opened and closed often enough the water level must be maintained at some point between the top and bottom lines of the receiver *R*. This feed is perfectly silent in action, and as the valves are positively moved, the device is more nearly certain in operation than any ordinary form of pump can be. Robert A. Bruce says in the "American Machinist" that this feed wastes very little steam. If this is true, then there would seem to be no objection to this "gravity" boiler feed for use in feeding any boilers.

Another correspondent, writing of this "gravity" feed, expresses the opinion that the receiver will be slow in filling. This is incorrect, as the receiver fills instantly.

In Fig. 3 *D* is the steam diaphragm which regulates the fuel supply, and I think that *S* is a supply hose from the water tank to the boiler, by which the boiler can be quickly filled with cold water from the tank by means of a hand-operated valve.

It will be seen from this description that the Piper & Tinker steam wagon has many original features. There does not seem to be any necessity for so much vertical hight of the boiler and firebox, as the vertical ½-inch flues in the upright water tubes are much more than the 27 diameters in length which Whitney and Stanley have adopted as sufficient; hence the seat could probably be lowered without affecting the efficiency of the boiler, thus bringing the wagon more nearly into the usual form of outline, if this is deemed desirable.

While this wagon weighs only about 300 pounds more than the Stanley, the fuel consumption is given by Mr. Piper as 3 gallons of gasoline for 25 miles run; while the Stanley wagon can cover 25 miles with two passengers up by burning only 1 gallon of the same fuel. This is a great discrepancy in fuel consumption, and seems to be mainly due to the form of burner employed. The Piper & Tinker engine bearings are all plain, the wheels only having ball bearings. HUGH DOLNAR.

On one of the cable railways in San Francisco the cable came in contact with a gas pipe and by its friction cut the pipe about half off. When a cable oiler struck a match in the pit an explosion occurred and the man was severely burned.

Aluminum now costs 35 per cent. less than copper, section for section.

Letters from Practical Men.

The Tool Lifter.

Editor American Machinist:

Mr. Plaisted, of Montpelier, Vt., has done us the kindness to suggest that the tool protector for use in planing T-slots, suggested in a recent article, has not only been used before, but that a barn door hinge, procurable at the hardware store for a few cents, will answer the purpose as well as one made for this particular use.

There appear to be two points to the gentleman's letter; first, that the device is not new, and second, that a less expensive device may be substituted.

In both points Mr. Plaisted does a good act in a good cause. It may be remembered, however, that, first, there are very few absolutely new and original things (to some of us); second, "there are several ways of killing a cat."

I think that the position which we who have grown gray in the service, should aim at in writing of these matters, in a paper as widely read in the shop as the "American Machinist" is, not so much to describe to the readers absolutely new things, which are the result of brilliant and exceptional genius and expected to produce new and marvelous results, but to bring to the minds of our younger brothers those things which we have learned by experience and observation to be good and useful in the everyday routine of the shop, and which they have yet to become acquainted with.

I sincerely hope that such may be the result of these articles, and with this view of the matter Mr. Plaisted has added his share to this particular subject, since, if he suggests something which costs only a few cents that will do as well as a device which takes several hours labor to construct, it makes little difference whether it is an appliance constructed especially for a barn door, or even the barn door itself. It is one of the marks of Yankee ingenuity to make the most common things serve good and useful purposes.

OSCAR E. PERRIGO.

New Haven, Conn.

Indexing Technical Literature.

Editor American Machinist:

While the matter of standardizing business cards, booklets, etc., and using the card system of filing for such a variety of purposes, is being discussed in your columns, I would like to say something regarding the "table of contents" of our technical publications. Some journals print the "Contents" on front of cover, some on first page of reading matter, some on last page, and some on one of the advertising pages. Now, when the "Contents" is printed on one of the reading pages it has to remain there, and if we want to look up any matter in a back number of the present volume (unless we keep an index, which not every machinist does) we often have quite a little trouble and loss of time. The "American Machinist" always puts the "Contents" *somewhere* in the advertising pages, and besides providing us with a little "amusing puzzle," also gives us a means of finding the articles, etc., later on, as we can tear out the leaf and always have it at hand to refer to, while the remainder of the paper can be safely stowed away until we need it again. But here is more trouble. On account of the system of numbering the pages of the reading matter, if the table of contents is to be of any use, we have to keep the whole leaf in order to know the date or number to which it belongs, or file a sheet 9x12 inches for what could easily be put in a space of 75x125 millimeters, which is a library bureau standard size, or perhaps the 10x15-centimeter standard would be more suitable, as some magazines of standard 6x9-inch size also print their "Contents" on an advertising page, in which case we can easily trim or fold to size.

I hope some more of your readers will give us their opinions of the matter, as I think it is of some importance. How nice it would be just now to be able in a few minutes to tell if an article on a certain subject was published in last year's "American Machinist" while that volume is away at the bookbinder's.

As regards writing an index to current technical literature, it involves considerable work, and then we are likely only to index just what we think at the time will be useful to us, and if a friend whose studies are in a slightly different line, asks for information we are likely to have to hunt for it. S. G.

Hartford, Conn.

[In a line to itself, near the top of the front cover page of the "American Machinist," is always to be found the number of the page on which the table of contents is to be found, and if this is known, the "amusing puzzle" referred to seems to disappear.—Ed.]

Trying to Locate the Trouble.

Editor American Machinist:

Tecumseh Swift, in his article answering "Superintendent," offers several broad hints, chief among them being lack of application and of good pay. But I think there are some other things that may prove equally bad. In our town there is a shop where high wages never have been the rule, but the proprietor has been kind and considerate. Quite recently, however, a "dago chaser" (contractor) was taken into the firm, and then there was a great change, the shop being moved into a barn-like building, with only a small stove for heat. On a cold morning the thermometer outside is about 14 de-

grees below and inside about 20 degrees above zero. The "firm" stay in the office (65 degrees) till 11 o'clock, then bob up serenely and smilingly in the shop and wonder (?) why more work is not done. With the noon mail will come the "American Machinist" with a cut of someone's chip 6 inches long or wide, taken on a finish cut, the person possibly not mentioning the size or kind of machine; but, no matter, he rushes into the shop, glasses in hand and fire in his eye, and immediately the man on the 10-inch lathe with spindley legs must speed up. He will read Jones & Lamson's "ad.," not far enough to know he should get a turret lathe (takes too many tools), but just to see how quickly they do this work, and immediately the man on the drill press and the man on the 20-inch lathe must hustle.

Since writing the above I have read the issue of January 26, and your editorial pertaining to the same subject provokes me to say "that is our old man," for when a man (paid $6 a week) is turning a shaft and walks away from his machine after starting a cut, he nearly goes into spasms. I am sorry this is not fiction, but as it is not we must hope he will grow with age.

"YELLER."

Some Reamer Experience.

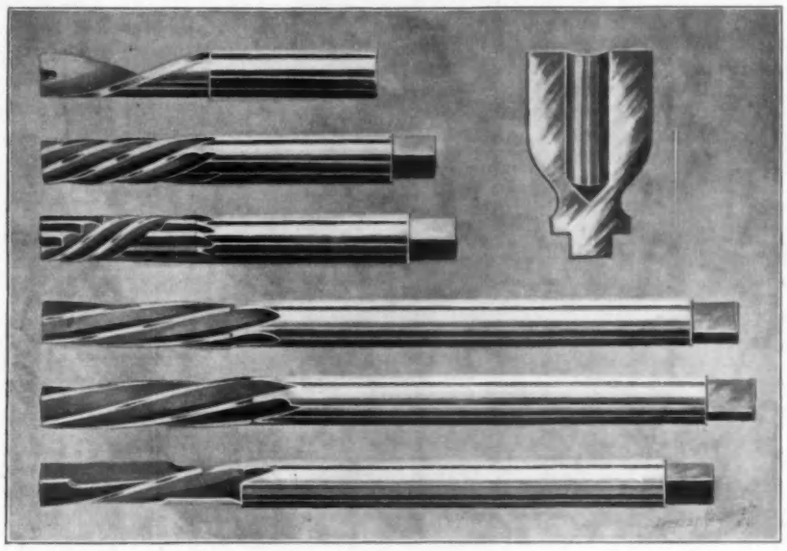
Editor American Machinst:

It seems quite a while since the reamer question has been stirred up. With the kind indulgence of the editor and readers, I will submit some experiments along lines partly suggested by Prof. Sweet and other contributors.

On the theory of non-chattering reamers I can offer nothing. I have made reamers that, theoretically, could not chatter, but the holes they made had chatter marks. The reamers submitted are the result of a necessity. We use a mandrel made of bronze and known in dental patter as a chuck. These are made to fit on a taper on the ⅜-inch armature shaft of a laboratory lathe and carry emery and other kinds of polishing wheels. Being subjected to severe duty and high speed, a round hole and a good fit are imperative. We are obliged to use a casting in order to get a metal suited to the work. The metal we found best suited to our purpose seemed least inclined to permit a perfect hole. We tried the taper reamers of commerce, reamers with no clearance, except such as we gave them with an oilstone; reamers with tangent teeth; staggered reamers; reamers with one cutting edge, two cutting edges, and spirals, without satisfactory results. Not until we made the ones submitted did we reach results approximately satisfactory. The single-lip spiral is a roughing reamer that leaves nothing to be desired. It is used in the turret after the drill and facing cutters, just a scrape being left for the hand reamers to finish. The two short reamers with nine teeth were not quite satisfactory. The other three make perfect holes. The even spiral and the staggered spiral do not cut as freely as the combination. The hole submitted is finished with the combination reamer. The conclusions I have reached are: First, that a spiral, either even or staggered, will not work well unless given more twist than is ordinarily recognized as standard; second, that too much spiral is bad on account of the tendency to force the chips into the hole and the great amount of forcing required to make it cut; third, that the combination of straignt and spiral teeth is far and away the best, as it does not require forcing, yet will stand any amount of it, and by no means can it be induced to chatter.

I do not feel able to do the roughing reamer justice; all I can say is try it. What the outcome will be with other sizes and tapers and with different metals I am not prepared to say. My faith in theories of reamers has been so shaken that nothing will convince me except "getting there." In this instance I got there, and if I hear of some others getting there, I may attempt to evolve a theory to fit the case.

W. A. WARMAN.



SOME REAMER EXPERIENCE.

Overdoing Underselling.

Editor American Machinist:

On first reading the article "Overdoing Underselling," in issue of January 26, the argument seemed sound; but further thought raised the questions: Is it justifiable to exact the highest price obtainable for our product? Is is not, rather, good business to sell for the lowest possible price consistent with a fair and reasonable profit? From an ethical standpoint the answer to the first question would undoubtedly be in the negative; but business is not always subordinate to ethics. As a matter of dollars and cents, then, which is the better method? Not merely in nuts and bolts, but in other lines as well, for the charge is made general.

Consul Halstead argues (and the "American Machinist" seems to endorse his views) that it is better trade to secure the largest possible profit on each individual order; but it seems to me there are to this, as to all questions, two sides. It is the question of the nimble sixpence versus the slow shilling, as it constantly recurs to all buyers and sellers of goods.

In business, as in other things, it is often advisable to cling to that which your rival condemns in your methods; and so where an English manufacturer, as quoted, says, "When big profits are in sight and possible, they seem willing to give away the benefits of your grand natural resources, of your manufacturing brains and tremendous energy, to Kaffirs, Cape Colonists and other Africans, to Australians, West Indians, South Americans, Japanese, and even to the 'heathen Chinee,' for a petty profit, simply because they have no knowledge of foreign trade, and certainly no trade patience." Now, it seems to me that this is really farsightedness in trade. If low prices stimulate buying, and the inhabitants of these countries are thus encouraged and educated to the uses and possibilities of machinery, and shown how to thereby develop their resources, will it not lead to largely increased demands for machinery and larger markets for our manufacturers?

Is not this desire for the highest price obtainable, this bleeding the consumer for all there is in it, akin to that which leads the workman to do no more than necessary to hold his position, or the employer to hire the man who will work for the least money? Yet this is generally conceded to be poor policy.

If our customers know that our prices are based, not on cost of manufacture and handling, plus a reasonable profit, but on what we think the market will stand,

will they not hesitate, waiting for prices to break; thus halting improvements, delaying progress, causing uncertainty and distrust? It not this at least as demoralizing to trade as the method condemned?

Moreover, it must be remembered that we are as yet but little more than entering in upon the field of foreign trade; that we have many obstacles to surmount, including not only the natural bias of the purchaser in favor of those productions with which he is familiar, but a prejudice—possibly partly justified, certainly assiduously encouraged by our competitors—against American goods. For these reasons it becomes necessary to cut prices, and to cut deeply, even, if the future possibilities of the market warrant it, to an extremely narrow margin of profit, and at times below cost, knowing that better prices can be obtained after we have gained a firm footing. Or, should prices remain permanently at a lower level, be it remembered that the low prices of to-day are the high ones of to-morrow; for, as you state in the article referred to, "the American mechanic has done his share very completely in reducing the cost of production, and is daily bringing it down to still finer lines"; and it is more than probable that by the time American products are thoroughly known and valued in these markets, the at present low prices will afford a fair profit.

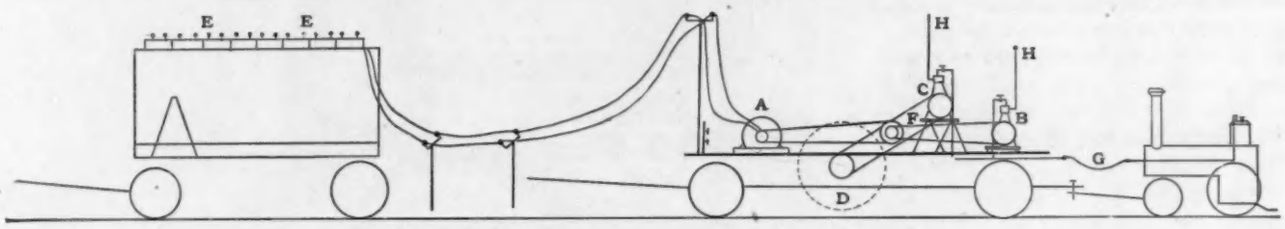
Consul Halstead has excellent opportunities for observation, and his criticisms may be more or less justified; but it seems to me a mistake to jump at conclusions, or to act without considering the question in all its bearings. C. W. PITMAN.

Philadelphia, Pa.

A Novel Mechanical Display for a Public Procession.

Editor American Machinist:

We had occasion to make an exhibit on floats of each branch of our industrial work, when our school was visited by President McKinley and his Cabinet. I was for a while at a loss to know how I would get something to represent the machine and engineering work. We had a double engine of ten horse-power in our machine shop which our students had just built, and a single engine of three horse-power which they had built a year before. I decided to place them both on a large float, to belt the single engine to a dynamo which we had, and the double engine to a mass of decorations on the sides of the float, which were to be in motion. We got our portable boiler from the agricultural department and pulled it behind the engine float, putting a section of steam hose between the steam pipes on the float and the boiler. In this way steam was furnished to both engines, and they did their work nicely. A number of incandescent lamps from the department of physics were placed on the first float, and a powerful magnet also was on this float. The lamps were kept burning on the line of march, and a number of electrical experiments were being made on the float at the same time. The wires from the engine and dynamo float were carried on small poles by a number of students, who allowed them to be slack enough to prevent their pulling loose, and the drivers were careful to maintain the proper distance. The whole exhibit proved a success, and was heartily cheered by thousands of people on the line of march. The sketch will give an idea of the arrangement: *A* is the dynamo; *B*, single engine; *C*, double engine; *D*, revolving decorations; *E*, incandescent electric lamps; *F*, jack-shaft; *G*, steam hose; *H*, exhaust pipes.



AN ELECTRO-MECHANICAL ARRANGEMENT FOR A PROCESSION.

HARRY E. THOMAS.

Tuskegee Normal and Industrial Institute, Tuskegee, Ala.

[It is scarcely necessary to remind our readers that the institution above represented is for the education and training of colored young men and women, and all connected with it, we believe, are colored people, its principal being the eloquent and able Booker T. Washington. Our correspondent is in charge of the machine-shop work.—Ed.]

Die Making.

Editor American Machinist:

The writer has followed the articles on punch and die making which have appeared in your columns of late. Since I am a practical workman, and have among my various duties the designing of all the tools and the supervision of making same in our factory, would suggest to the readers of the articles before mentioned that they must not think after making a few single dies that they are full-fledged die makers, as it is a branch of mechanics which can only be understood fully after years of practice. Close competition in manufacturing is compelling manufacturers to hire the highest skill obtainable in this art. For instance, our company has for years, until recently had a certain piece made outside by one of the largest brass companies in the country, at what was considered an almost ruinous price. We could not obtain it made for almost twice the figure we were paying anywhere else. At present we are making the same piece for less than half of what we paid before. How were we enabled to do this? Simply by a very ingenious punch and die, and it has more than paid the cost of making in the first lot of work made from it. I have some good machinists working for me, but they will never be able to make anything in the punch and die line other than simple piercing and blanking tools. I would not try to discourage any young or old mechanic trying his hand at it, but after a little success he must not think he knows the business. At first a man who has worked in watch or spectacle shops would not amount to much in a clock factory, nor do the men who have worked in one clock factory amount to much when they shift to another. I have had very highly recommended workmen come to our place, and could see that they were good in their line, and have endeavored to carry them, thinking they would pan out all right in time; but it has almost always proved a failure. What we need is young men with good thinking faculties; not too much ambition, as that leads them to think they are fitted for higher positions, and they prove slow, as they always think they are underpaid. They hear what they pay so-and-so at some other factory in another line, and are restless until they get a swing at it, and nine times out of ten are entirely unfit for the place they undertake to fill. I believe in every man advancing himself, but it takes more than the skill of die making for a man to advance himself very high. He must study and content himself and think first before jumping from one place to another.

THOS. W. R. MCCABE.

Winsted, Conn.

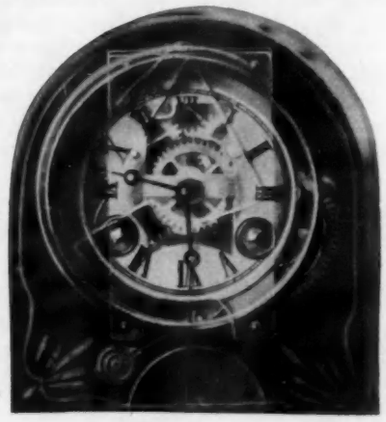
Machine Photography by Installments.

Editor American Machinist:

This is a picture of a clock representing to some extent both the inside and the outside of the case. It serves no useful purpose except to illustrate the manner in which it was made and to assist

others who may wish to make such pictures of different machinery. It is not an x-raygraph, it is not a "freak" photograph. It was made by a common lens on an ordinary plate, and there was nothing very extraordinary in the manner of taking. The whole secret lies in the fact that the same plate was exposed twice, once on the outside of the case and once more on the works with the hands and the dial removed, in each case giving only one-half the time which would usually be allowed the same plate on the same subject. To guard against over-exposure a little bromide was used in the developer.

Now, there is nothing new in this ex-



A "GHOST" PHOTOGRAPH.

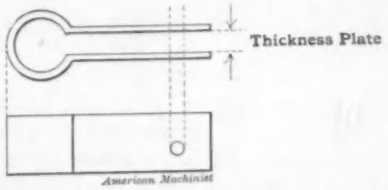
cept in its application. "Spirit" photographs and composite portraits are made in much the same way, but it would seem as if a legitimate use for the process might be found in illustrating machinery, since it is possible to represent the outside casing or frame as being transparent, and through it showing portions of the interior mechanism. Some of the best wood engravers are able to so represent machinery in their cuts, but the work requires unusual skill and is consequently expensive. There would seem to be no reason why anyone familiar with a camera, which most large concerns now employ, should not be able to produce this effect with hardly more expense than an ordinary view. Several exposures may be made, each time removing such portions of the machine as conceal other parts which it is desired to illustrate. The interior views might require more exposure than the exterior, and a little judgment must be used in dividing up the time so that the whole exposure will not exceed that usually allowed. Both the camera and the object must, of course, remain stationary during the entire operation.

W. H. SARGENT.

Marking Holes on the Other Side.

Editor American Machinist:

As a shop kink that may prove of interest to some readers of the "American Machinist," I saw one the other day used by some stack builders, who were putting up a stack for us, and which was new to me. The base of the stack was rectangular, and upon it they had a band of metal riveted. The base upon which the stack went was on a slight slant in two directions, which the man, as usual in such cases, did not take into account when measuring for the stack. However, when the stack was placed plumb this left an open space which looked unsightly. I condemned the work, and ordered the old band cut off and a wider one put in its place. They slipped this new band on with the stack in place, and allowed the ring to take a natural bearing on the base. Then from the inside of the stack they scribed from the old rivet holes which were in the stack on to this band. When they took the band off and took it to the drill press we discovered that on account of its shape and the design of the machine, we could not drill it from the inside, and it was therefore necessary to transfer these holes to the outside of the band. I was just thinking about the gymnastics that would be necessary to go through with, with the surface plate, square, surface gage, scale, etc., to get these holes accurately transferred. The sheet iron man, however, said, "H——l, that's easy," and proceeded to get out a little trick which proved his words to be true. He simply took a piece of sheet iron about 1-32 inch thick, 1½ inches wide and about 5 inches long, brought the ends together, and hammered it flat around a 1-inch piece of round iron, punched a hole same size as those in stack clear through both ends at once, and then separated the parallel lips until the thickness of the band would pass in, bringing the hole on one side coincident with one of the circles scribed from stack, holding



BOLT HEADS IN POCKETS.

it in that position, scribing on the other side, and doing the whole thing in less time than, with the proper tools and preparation necessary, it could have been done in the usual way.

S. E. FREEMAN.

Marking Drills.

Editor American Machinist:

We all hope that "'Odd," who gave his drill-marking idea to the public in your issue of February 2, will publish his next new one a little more promptly.

It will not be safe for him, or anyone else, to put that idea into practice without first consulting G. L. Holt, who, from Springfield, Mass., made the same idea public October 6, 1891, in patent No. 460,639. The application date is March 7, 1889.

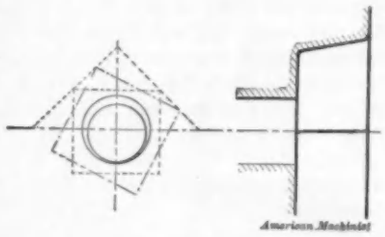
Full many an ingenious gem of purest ray serene finds that it is not a solitaire when its owner takes the trouble to fathom the records of the Patent Office. It is, however, my recollection that I have seen similarly marked drills in the market, though I could not make affidavit to it.

NOVICE.

Bolt Heads.

Editor American Machinist:

Your diagram of bolt weights, given in the "American Machinist" of January 5, 1899, recalled an experience with a line



BOLT HEADS IN POCKETS.

of pedestal boxes. These boxes were designed to prevent the cap bolts from turning by casting a pocket, shown in Figs. 1 and 2, to hold one corner of each of the heads. These pockets were made with about 3-32-inch clearance around the heads, to save chipping out corners if broken in the molds. The dimensions for laying out the pockets were taken from a United States standard bolt list.

A workman, who was observed drilling a lot of boxes, gave as his reason that the bolt holes were cored too small. Investigation showed that the bolts intended for these boxes could not be used since the heads were less than standard size, and turned around in the pockets, as shown by the dotted lines in Fig. 1. As these bolts are a standard market article, the patterns were changed to suit them.

A near-by bolt concern makes the statement that their bolt heads measure, across the flats, 1½ diameter of bolt + 1-32 inch, and in thickness, diameter of bolt — 1-16 inch. Other manufacturing concerns are making them even thinner. They make the statement that tests have proved that heads so made are as strong or even stronger than the rest of the bolt. The small heads save weight, which, considering the low prices of the market, is an important item. A number of bolts, ½ inch to 1⅛-inch diameter, used on a bridge put up by a Pennsylvania concern, gave as the average dimensions across the flats, 1½ diameter of bolt; thickness of head, diameter of bolt — ⅛ inch.

By the first class of dimensions we save on a ½ inch x 2½-inch bolt, square head, about 14 per cent. of the weight, and by the second class, 22 per cent. On a ¾

inch x 4-inch bolt the saving would be about 11 per cent. and 14 per cent., respectively.

As we practically have two standard sizes of threads, the United States standard, and the rough, or Merchants' standard, which is 1-32 inch larger, do we not also have two standards for bolt heads?

W. SANGSTER.

An External Spacing for Cutting an Internal Gear.

Editor American Machinist:

We had to cut an internal gear too large for our regular gear-cutting facilities, and a special device was therefore necessary. The gear was quite large in proportion to its pitch and width of face, and had arms thin and weak. It was decided to plane the teeth, and the question of properly indexing was then the principal point involved. As the gear was to run rather fast, it was necessary that this should be correctly done. The following method was adopted, and the result was quite satisfactory.

To the outside of the pattern was added the projecting rim *a*, Figs. 1 and 2, and the casting, which was of bronze, was chucked out and turned up on an arbor in the usual manner. It was then put into the gear cutter and the rim *a* cut as an external gear, in as many slots as the internal gear was to have teeth. The cutter used was, of course, one of straight sides, slightly narrower at the edge, so as to make a slot with inclined sides. An angle-plate *A* was then fitted up by fixing in it a stud *b* to carry the gear blank. The bracket *D* was bolted to the angle-plate as shown, and the indexing pointer *d*, with its lower end shaped to fit the indexing slots, was fitted in a groove planed in its face, and held by two bolts passing through slots to allow it to be lifted out of the indexing slots. Near the lower side of the angle-plate, and in line with the rim of the gear blank, were placed two bearer screws *e* (only one of which is shown), with check nuts on each side of the angle-plate.

The angle-plate being bolted to the planer table, the usual form of planer tool for such work, as shown at *F*, was used, and operated by the down feed, the depth of the tooth being determined by the turns of the vertical feed screw, and the crank stopping at a marked point. As each tooth was finished, the index pointer *d* was raised, the blank turned one slot, and the pointer again fixed and clamped in place. After the teeth had all been cut, the indexing teeth *a* were turned off and the outside of the rim finished.

Doubtless the job could have been done by clamping to it a gear already made—say, a change gear of a lathe, had one been available; but there would have been the risk of springing the gear and of getting an imperfect job. Various other devices might have been adopted, perhaps with equally good results; but this plan seemed to commend itself as the best under all the circumstances, and the result showed that it was practical, and a very accurate job was produced.

OSCAR E. PERRIGO.

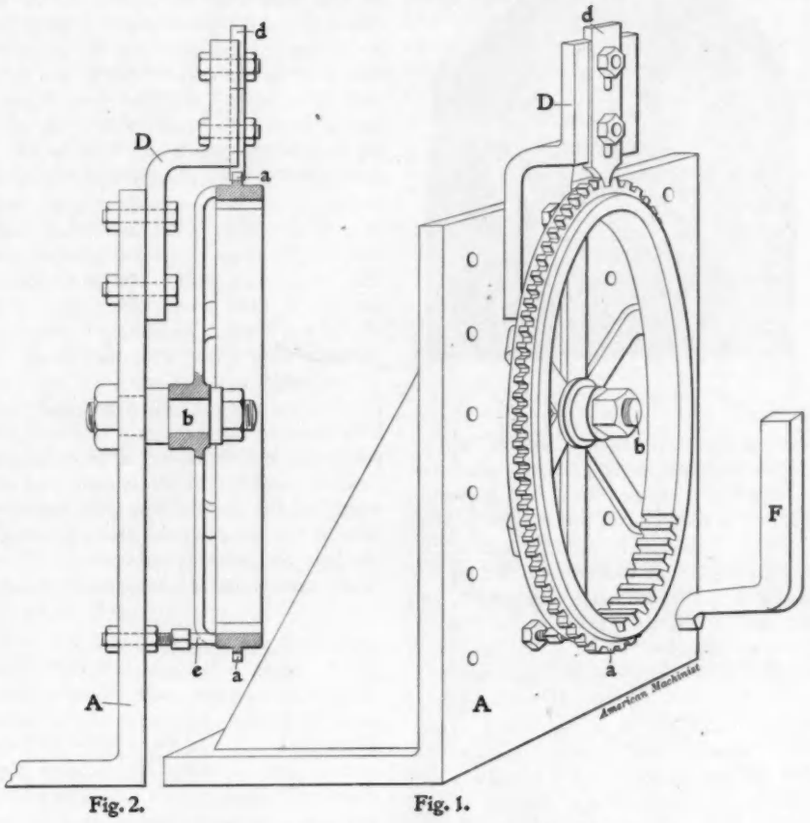
New Haven, Conn.

Crank Shaft Steady-Rests.

Editor American Machinist:

In turning the wrists of long crank shafts light cuts are commonly in use, because the crank shaft is not sufficiently rigid to stand any rushing work. At the shops of Struthers & Wells, Warren, Pa., where a great number of solid crank shafts are made, a steady-rest with an eccentric bushing is used for work of this sort, as shown in Fig. 1, which gives a very clear idea of the general arrangement. This steady-rest construction is shown in some detail in the enlarged view, Fig. 2. The writer has often felt the need of a contrivance of this sort, but was not aware that anything of the kind had ever been constructed. Mr. Davis, foreman of the Struthers & Wells machine-shop department, said that the device was original with that shop and had never, to his knowledge, been used elsewhere, though, of course, it may have been. The crank shaft shown in process of having its wrist turned in Fig. 1 had a crank radius of 7½ inches; this, of course, calls for a corresponding 7½-inch radius between the crank-shaft eye in the steady-rest bushing and the bushing center, and brings the whole diameter of the bushing up to something like 22 inches. The general form of the bushing is very clearly shown in Fig. 2, which also shows the set-screws by which the bushing is secured to the crank shaft.

In the construction of an eccentric-bushing steady-rest the frame is fitted to the lathe in the usual manner, bolted in place, and bored out with a boring bar to the proper diameter, straight cut, without ribs or flanges. In fitting the eccentric bushing the eccentric eye is bored first to the finished diameter of the shaft to which it is to be applied; this eye being located, of course, a proper distance from the center of the rough bushing. After the eye is bored the set-screws are put in, and the bushing is then placed on an arbor of sufficient length to take the crank-shaft turning-arms and a counter-balance arm, and then placed in the lathe on the crank centers, same as if it were a crank shaft, and the outside of the eccentric bushing is then turned to a running fit in the steady-rest frame, straight cut.



EXTERNAL SPACING FOR AN INTERNAL GEAR.

The eccentric bushings at the Struthers & Wells shops have a grape-vine oil groove chipped around the circumference. The whole construction is so simple as to need little more than the pictures to enable any shop to produce a similar appliance.

A considerable number of the Struthers & Wells crank shafts are fitted with disks, and when so fitted the crank shaft re-

quires what is called a "heel-and-toe" finish—that is to say, to be turned on crank-arm centers in the lathe having half the throw of the wrist centers, the cut being passed over the ends of the crank arms of the crank shaft. Thus in the present case the wrist radius being 7½ inches, the heel-and-toe turning centers would have a radius of 3¾ inches. This, of course, calls for a second bushing of 3¾ inches radius, and having the same outside diameter as the crank-wrist bushing. In using these bushings on a crank shaft in process of wrist-turning, the bushing is slipped on and lightly secured with the set-screws, as nearly as may be in the proper position with relation to the center of revolution. The eccentric bushing is then trued up by chalking and moving on the crank shaft. This is an operation which requires some care and takes some time, but Mr. Davis informed me that by the use of the eccentric bushing, he was enabled to turn crank shafts with certainty and safety, which would be very difficult to produce without this support, and he said that he believed that, taking one job with another, the eccentric support would save from 30 to 40 per cent. of the time required in the lathe, because of the heavier cuts which could be taken. When these pictures were taken the shaft in the lathe was so long and slender that it would have required great care to produce satisfactory work without the rest, and it seems that this form of steady-rest may be used to advantage in a large class of crank-shaft turning.

JOHN RANDOL.

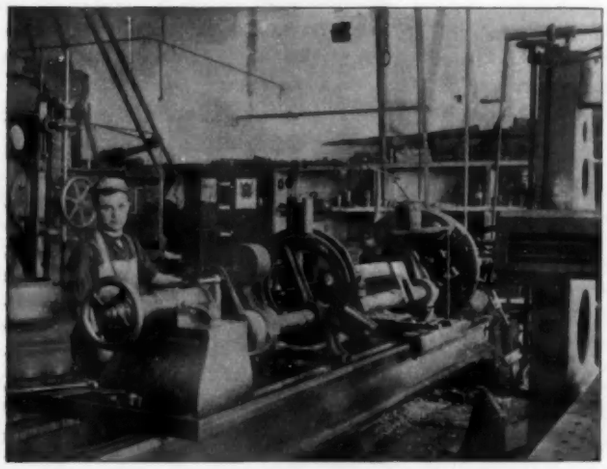


FIG. 1. STRUTHERS & WELLS ECCENTRIC STEADY-REST BUSHING FOR LONG SHAFTS.

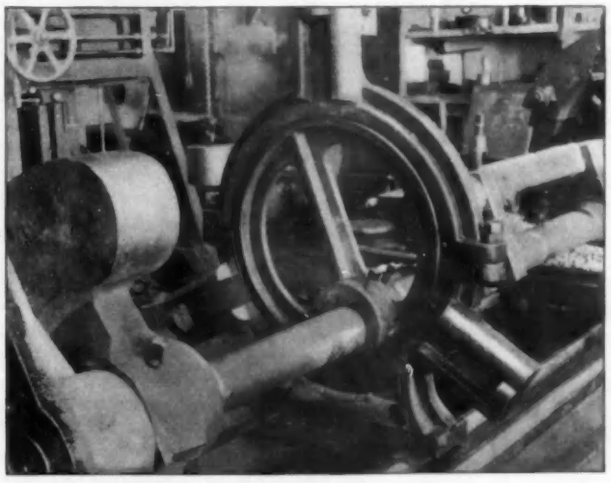


FIG. 2. CONSTRUCTION OF STEADY-REST AND ECCENTRIC BUSHING—ENLARGED VIEW.

The Crowding to the Right of Rivers and Railway Trains.

A correspondent has been led into serious trouble by the little allusion, in our issue of October 27, 1898, to the long-known fact that rivers running either north or south have a slight tendency to crowd against the right bank, looking down stream. Our friend writes that "it has stuck not only myself, but every person I have put it to, and I am compelled to ask your explanation in detail, and also to request that you publish it, as I think there are some other 'blockheads' besides those of my acquaintance. Just south of our city (Lancaster, Pa.) the Conestoga river flows almost south, near enough for the purpose, and several miles directly east of it Mill Creek flows almost due north. Now, why should the one crowd to the east and the other to the west; and, if they do, what is there in the earth to cause them to have this tendency?"

Now, this is evidently a serious case, and it demands our most serious efforts at elucidation. This natural tendency of the river is rather a matter of pure theory than anything else, and is to be thought of only in connection with the large rivers, such as the Mississippi, flowing south, and the Nile, and the large rivers of the Russian Empire, the Obi, the Yenisei and the Lena, flowing north. The tendency no doubt exists, but it may be defeated by differences in the conformation of the land, or in the ease with which the banks yield to abrasion. With only a slight tendency to crowd to the right, it might still happen that the left bank was the softest, and so would yield the most.

When we remember the constant rotation of the earth toward the east, and the continually varying diameter of planes passing through it parallel to the equator as we go north or south, and the different lineal speeds of its surface due to the different diameters, the phenomenon of which we are speaking would seem to be easy of explanation. Take a river flowing south in the northern hemisphere, and select upon it a point, say at 45 degrees north latitude. The water here has a compound motion; there is the regular motion of its flow to the south, and a movement to the east with the earth. Now, as the water flows on to the south, its natural tendency is to continue moving to the east at precisely the same rate. It will not move to the east any faster or slower except for cause. It happens, however, that the water is flowing into a region where the surface speed of the earth caused by its daily rotation on its axis is greater, and as the river flows along, if it does not crowd the right bank, the right bank certainly crowds it, and by that crowding increases, as required, the rate of easterly movement of the water of the river.

When the river flows south it is the right bank that crowds the river, instead of the river crowding its right bank; but when the river flows north it acually does the crowding, and it is the bank then which is crowded. In this case the water, with its easterly movement corresponding to the locality, and with its natural tendency to continue to move easterly at precisely the same rate, is flowing into a region where the earth's surface moves eastward at a reduced speed, and then of course the crowding is literally done by the river, while the bank offers its resistance.

By the same operation it must be easily understood that all rivers flowing north or south in the southern hemisphere must crowd to the left instead of to the right, and railroad trains in either hemisphere must, theoretically, have a corresponding tendency whether the effects of it are discoverable or not.

If we imagine the water of a river or a railroad train so close to the pole as to have little or no motion due to the earth's rotation, and then to move over the surface of the earth to the equator, it will have, when it arrives, a motion eastward of about 25,000 miles in twenty-four hours, or, say, 1,000 miles an hour, and this velocity has been imparted to it solely by the crowding of the right-hand bank of the river, or of the right-hand rail in the case of the train.

AMERICAN MACHINIST

Published Thursdays by

American Machinist Press,

218 William St., New York.

JOHN A. HILL, President and Treasurer.
A. LEIGHTON DONNELL, Sec'y.

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Subscription Price:

$3.00 a year in advance, postage prepaid in the United States, Canada and Mexico.

$4.00 a year to other countries, postage prepaid.

Agents for Great Britain:
CHAS. CHURCHILL & Co.,
19 Leonard St., Finsbury, London.
FENWICK FRERES & Co.,
21 Rue Martel, Paris,
Representative for France, Belgium, Switzerland and Italy.

Entered at Post Office, New York, as second-class mail matter.

For Sale by Newsdealers, everywhere.

No back Numbers beyond 1898.

American Locomotives in England and Their Cost.

In an address delivered at the annual dinner of the Yorkshire College Engineering Society at Leeds, England, January 28, Mr. J. H. Wicksteed, whom our readers will remember as the inventor of the testing machine that bears his name, and as superintendent of the works of Joshua Buckton & Co., is quoted in the press as saying:

"The Midland Railway Company had ordered twenty locomotives from the United States. The reason for that was that they wanted the locomotives, and could get them in three months from America, and for £500 less per locomotive than in England, where they would have to wait for fifteen months nominally—(laughter)—and possibly for two years. (Hear, hear.) These locomotives would be of the mogul type. With a view to safety, the locomotive superintendent had made special specifications as to axles and axle boxes, and had required a copper firebox, because with the fuel and water to be used a steel firebox would not answer. But the rest of the locomotive would be American, and we should shortly have twenty of them running on the Midland Railway for goods traffic, and would see how they compared with English locomotives in cost of maintenance and of fuel. These American locomotives had been used with satisfaction in Mexico and other places, without undue cost of maintenance for five years past, and it was likely that they would be 'an eye-opener' to those in Midland shops themselves, and would emphasize the mistake that English working men were making, because, though American workmen produced a locomotive for £500 less, they did not carry less money home, they carried more. (Hear, hear and applause.)"

This would imply that the difference in cost between an American and an English locomotive is due entirely to differences between British and American workmen in locomotive shops, which is notoriously not the case. The British locomotive is not the same machine as the American, and it must necessarily cost more even if built in the same shop and by the same workmen. Then again there is a difference of methods and in equipment of shops, for which the British workmen cannot be held accountable. The designer and the works manager or superintendent and the owner of the locomotive building establishment as well, must be brought into account before we can give a full and satisfactory reason for the higher cost of British locomotives.

The Navy Personnel Bill.

At this writing, what is known as the "navy personnel bill" has just passed the Senate with practically no opposition, and will, in all probability, soon become a law.

The chief feature of interest in it to our readers is in the fact that it eliminates the "line and staff controversy" by practically making the engineers indistinguishable from line officers. In other words, certain line officers who may choose engineering duties or may be assigned to them, will do duty as engineers, but will still be line officers, with all the rights, rank and standing of other line officers.

This is probably the best that could have been done at this time, but we cannot help wondering what will happen when the present generation of engineer officers has passed away, and all the engineer officers then in the service will have had none of the peculiar experience of the present men, but instead, will be, so far as we can see, much the same men as the line officers of to-day are.

We believe that the real work of managing and keeping in order engines and other machinery of naval vessels will in that time be done by men not recognized as engineers, and that a fight for their rights and for recognition of the important duties performed by them will have then to be made.

When that day comes we hope the "American Machinist" will be found on the side of the men who really do the work, as it has been in this case, so far as the controversy between the engineers and the line officers is concerned.

The ultimate effect of the amalgamation will be, we suspect, to develop a class of line officers having all the characteristics, aristocratic notions, etc., of the present line officers, and with just enough dabbling in engineering to bother and harass those who must really do the engineering work.

In our opinion, after the new plan has been in operation for a sufficient length of time the navy department will have no further trouble in retaining the officers assigned to engineer duty. Outside concerns will not offer them inducements to quit the service, though, of course, there will continue to be, as now, here and there an exceptional man in the service who will, in spite of repressive and ambition-destroying influences, be valuable anywhere in or out of the navy.

Remove the Naval Officers' Halo.

The Sampson-Schley controversy that is now going on in the Navy Department and in the newspapers will have one good effect if it teaches a lot of people who ought to know better not to imagine that every line officer in the navy wears a halo about his head, and that it is sacrilegious to even hint that he may possibly be influenced in his opinions or actions by some of the ordinary common weaknesses of poor human nature, such as selfishness, jealousy, covetousness, etc. The notorious Navigation Bureau clique is being exposed, and it is being made plain that there are wire-pullers and schemers and petty politicians among the naval officers—men who do not hesitate to conspire against those who do not belong to the clique, or who for any reason do not please its members.

All this has a direct bearing upon the "line and staff controversy," and its ultimate effect will be wholesome in just that degree to which it teaches Congressmen and others to look upon a naval officer as being much the same as men in other walks of life—no better, no worse—but always to be watched, the same as other men who are given power which they may be tempted to abuse.

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer by mail.

(21) W. T. G., Tacony, Pa., asks: Can a gasoline engine operate machinery under water about fifty feet deep without discharging exhaust above the surface, and is there any other means or way of dis-

charging exhaust below water without disabling the engine. A.—We know of no way of discharging the exhaust below the surface except against the pressure of the surrounding water, which in this case would be about 25 pounds to the square inch, and this would be about the minimum back pressure. The gases so discharged would immediately rise to the surface in bubbles.

Personal.

Mr. P. McN. Bennie, recently with the Washington Carbon Company, has been appointed secretary of the Acheson Graphite Company, of Niagara Falls, N. Y.

The Franklin Institute has awarded to John W. Hyatt, for his invention of the spiral elastic roller for bearings, the John Scott Legacy Premium and Medal.

Mr. Edwin S. Boyer, formerly of Philadelphia, has been appointed the New York representative of the American Engine Company, of Bound Brook, N. J., and will have his offices at 97 Liberty street, N. Y.

Obituary.

Luther Chapin, founder of the Senior Order of United American Mechanics, died in Philadelphia, February 19; eighty-three years old.

James Brogan, general manager of the Thompson Iron Works at Niles, Pa., accidentally fell into a vat of vitrol while making his monthly inspection of the plant and died in a short time after intense suffering.

Lewis T. Haskell died at Pawtucket, R. I., February 12; seventy-four years old. He learned the machinist trade at Woonsocket, R. I., and later worked for the Eagle Screw Company at Providence. In 1853 he founded the bolt and screw business of Pinkham, Haskell & Co., later selling his interest and engaging in a stove and tinware business, from which he retired with a competence in 1888.

John Kreusi, chief mechanical engineer of the General Electric Company, died at Schenectady, N. Y., February 21; fifty-six years old. Mr. Kreusi was a native of Switzerland, and had received a liberal mechanical and engineering education before coming to this country in 1870. He was for a long time connected with Thomas A. Edison at Menlo Park, and is said to have constructed the first phonograph. When the Edison Electric Company was organized he was made superintendent, and when the factories were consolidated he became general manager. Mr. Kreusi became a member of the American Society of Mechanical Engineers in 1894.

David Bradley, president of the David Bradley Manufacturing Company, and founder of the town of Bradley, Ill., died in Chicago, February 19; eighty-seven years old. Mr. Bradley was born in Groton, N. Y., and at an early age went to Syracuse, where he became a molder and gained a general knowledge of the plow business. In 1835 he established the first foundry in Chicago and received the first shipment of pig iron made to the city. Later he established a plow factory and the pioneer agricultural implement works of the West. His ambition to see the company bearing his name occupy a leading position led him to move the works and to establish the manufacturing town which bears his name.

Inquiry for Machinery.

94. For makers of machinery used in manufacturing umbrellas, especially ribs.

Commercial Review.

NEW YORK, FRIDAY EVENING,
February 24, 1899.

MACHINISTS' SUPPLIES.

The winter of 1899 will be remembered as one of particularly wholesome and active business conditions. In the general revival the numerous minor lines which go to lubricate the wheels of industry have not been forgotten. Both January and February have been good months for the supply market. The latter month has been handicapped by exceptionally cold weather, by a snow blizzard and by two commemorative days of defunct presidents. Encouraging reports are now, however, so numerous among the variously shaded ones received that it does seem quite fair to call business even better than it was a month ago.

"PRICES ARE ADVANCING

all along the line," is a universal cry among the trade. When reduced to their component elements, the facts do not show that files, drills, emery wheels, wood pulleys and small tools generally are more expensive than they were at the beginning of the year. But metal goods of many sorts, particularly pipe and steam fittings, have been greatly influenced by the rise in raw material. One of the latest advances is upon cold-rolled steel shafting, and it is said that turned is also increasing in price. Many makers of blacksmith's vises have advanced prices about 10 per cent. Brass machine screws have just been advanced, the discounts having been changed from 60 per cent. on flat and round head screws to 50 per cent., and from 50 per cent. on fillister-head screws to 40 per cent. Starrett's No. 9 combination set of squares and protractor and No. 12 improved bevel protractor are among the specialties that have been advanced somewhat. Taken all in all, this is an era for increasing prices, and one may expect to hear higher figures quoted almost anywhere. Some of the present demand for supplies is attributed to the attempt upon the part of large buyers to "cover their shorts" in anticipation of having to pay more if they wait.

The late enormous advance in the price of copper is illustrated in a story, which easily may be true, that one of the most important street railways in Greater New York, having previously closed a contract which permits it to replace its trolley wires throughout the system by wire 33⅓ per cent. heavier at a certain price, is now taking all the old wires down and selling them for more than enough to pay for the new.

TWIST DRILLS.

The local office of one of the large twist drill companies is deluged with orders. In spite of the blizzard, February's sales tend to show an increase rather than a falling off, as compared with January's. Another house reports January's trade in drills, chucks, etc., the best of any month but one on record. The present month, although not equal to last, is probably better than February, 1898. Some variations of the tale as told by other drill sellers are, that the New York market is not doing well in comparison with the Chicago, and that buyers are hanging back because of the 10 to 15 per cent. advance made by the combination toward the close of last year. Someone else, however, optimistically remarks that the advance in drills occurred at a fortunate time for manufacturers, for it was followed by increases in other lines which distracted buyers' attention from the drill market. The price since the advance is considered to give manufacturers a reasonably large profit. The agreement has been adhered to pretty long, as such things go. A local seller who has for five years been dealing successfully with a New England buyer who is accustomed to make contracts for future delivery, tells us that he has been caught by the raise in price. About the first of July last the buyer contracted for $5,000 worth of drills at prices then ruling, and subsequently figures went lower for a time, but the advance made by the combination has left the seller in the lurch.

FILES.

We have direct information from the Arcade File Works and from the Kearney & Foot Company that the demand for files is good and shows general improvement. From indirect reports we understand that the Nicholson and the Barnett works also are busy. These four reports make a pretty strong weight of evidence as to that line. Remarks one of the proprietors of the Arcade File Works: "February is witnessing an unprecedented demand. Jobbers are buying very freely." Some of the present orders for files are apparently due to the anticipation of higher prices, which are a possibility of the not remote future, though they are hardly a probability of the very near future. There has been some talk of a combination among file manufacturers, and one or

more meetings have been held within about two months past, at which it is believed closer relations were discussed; but file manufacturers deny that they are at present likely to enter into any consolidation. It is well known, of course, that there has long existed an association of American file manufacturers which has more or less influence in regulating prices.

EMERY WHEELS.

Demand since the first of the year has been heavy. One house sold a greater quantity of emery and emery wheels in January than in any other month on record, except one about five years ago. It finds business quieter since the blizzard, but regards February as normally a month of lighter sales than January. The agents of another emery-wheel company—about the most important of any—notice a continued improvement in the very urgent call for their goods, the tendency of February being toward greater sales rather than less. They notice that large metal-working shops in this vicinity are placing more extensive orders and ordering bigger wheels, showing heavy contracts on hand. Another important emery-wheel house reports January as a month of good sales, showing an increase over the same month last year. The first two weeks of February were quiet, and the total for the month will probably fall below the corresponding one in 1898. Trade, however, has resumed its January activity during the latter part of this month, and March is expected to bring a further increase in orders. This house made some sales of wheels to Mexico and Venezuela in January, and this month has on hand good European orders from Sweden and elsewhere.

POWER TRANSMITTING MACHINERY.

Those leading houses in this line clustering on Dey street, New York, are almost overwhelmed with work. Not only does this winter's business exceed that of last winter, but February is, if anything, ahead of January. The business of the Webster Manufacturing Company, some 60 per cent. of which is in the power transmitting machinery line, for January, 1899, ran 75 per cent. ahead of January, 1898. This includes both the Eastern and Western markets. A wood pulley house reports for January a 50 per cent. increase over January, 1898, and estimates for this month 35 per cent better sales than in the corresponding one last year. Wood pulleys are a very active line, as this company is not alone in observing. Trade in New York and in the regions west and south of it has improved, the manager remarks, while in New England it is rather quiet. "Wood pulleys are in active demand," says another seller, "and also hangers. Shafting is in fair demand. Cement mills are now among the most conspicuous buyers of our power transmitting machinery. Our present business is such that we are not inclined to take rush orders." "Our office force is overtaxed," says a member of another large firm. "It is hard to find new men who understand this line of business as well as is requisite, and our present trade is more than we can easily attend to. Tobacco mills may be mentioned as prominent among our customers at this time. We do not make much attempt to enter the New England market. There are many handlers of cheap material in that section."

The George V. Cresson Company has some large contracts, particularly from the West. For the Cleveland Rolling Mill Company is being built a 2,000 horse-power rope drive and heavy shafting; for the Dillon-Griswold Wire Company, Sterling, Ill., a large rope drive with heavy shafting; for an addition to the paper mill of the New York & Pennsylvania Company, a shafting outfit. The shafting equipment for the large paper mill of Ernst R. Behrend & Co., at Erie, Pa., is now being erected.

LEATHER BELTING.

Judging from reports of the largest manufacturers in the city, demand for belting is excellent, showing a continuance of active trade which has been prevailing for several months. Some makers were doing a good business at this time in 1898, so that it is not necessary to show a startling increase as compared with a year ago in order to demonstrate present prosperity. A partner in one of the best-known firms speaks as follows: "Cotton mills in various sections and other manufacturers are buying freely. At present sales of belting are especially for the plants of established manufacturers, rather than for new mills. This feature of industry I regard as healthier than the reverse would be. I judge our business to be about 10 per cent. greater at this time than it was a year ago. The domestic market we are finding of rather more consequence than the foreign, but the latter is excellent. We are selling quite heavily to Russia and other parts of Europe. We are also doing quite a little business with Cuba, where the sugar mills are being re-equipped." Remarks a representative of another large belting house: "Good orders are now coming from Southern textile mills. The New England demand is just about normal. In the spring lumber mills, particularly in the northwestern part of the country, usually enter the market for belting. We therefore anticipate an increase in trade shortly from this source. It is a little early for it yet. In general, home and foreign trade is holding on well among belting manufacturers, and may be pronounced very satisfactory."

MISCELLANEOUS.

Remarks a seller of wood pulleys who is pretty observant of industrial conditions: "The small machine shops about here are busy, and the large iron works are more than busy. The large shops are refusing work, and consequently people who have repairs to be made have to go to the smaller shops, although these, not having the facilities for doing the work as rapidly as the large ones, are obliged to ask more for it."

The senior partner of one of the largest supply, hardware and machinery houses in New York observes: "People are now buying a good many anvils, vises and forges. This seems to indicate that new men are being added to the shops, for those tools are the kind for permanent individual use. Good orders for an article for general consumption, such as files, do not have the same significance." In another large store where is sold a varied assortment of goods related to machinery, blacksmiths' tools are pronounced as particularly in demand.

The New York branch of the Q & C Company has recently moved into a large store at 106 Liberty street. We learn from them that the company, through its various branches, is doing an unprecedentedly large business in coal-cutting machinery, pneumatic tools, pressed-steel box lids, seats for agricultural implements, brake-shoe keys, etc. The demand comes from all over this country and from Europe as far as Russia, Sweden and Norway. Home orders indicate activity in the steel industry and the railroad and car shops. The only part of the country which has not responded fully is New England, where the slowness of woolen and cotton mills to feel the business revival affects the machine shops dependent upon them.

Chaff cutters and hand and horse-power threshing machines are in good demand in England. Consul Marshall Halstead, at Birmingham, has been asked for names and addresses of manufacturers of such machinery and he will forward information sent him to the parties who have requested it.

The Congress of Ecuador has enacted the following law:

"Article 1. Machines and machinery intended for the encouragement of agriculture and manufactures will be released from the payment of all import duties.

"Article 2. In like manner no import duties in cotton, ginned or unginned, will be exacted for the term of two years from the promulgation of this decree."

NEW ENGLAND REPORT.

In other parts of this article have been given some reports from the New York trade unfavorable to the state of activity in New England. They have reference largely to the textile industry, and should not, even as to that, be taken too literally as a criterion of sluggishness. A representative of the "American Machinist" has just been visiting New England machine tool manufacturers and can testify to very favorable conditions in that line.

The machine tool shops of Worcester

and Providence are humming with activity. The various shops are three to seven months behind their orders and the output of Worcester is larger than ever before in the history of the city. Prices have been pretty generally advanced, in some cases 5 and in others 10 per cent., though further advances are considered inevitable. Our representative was told of one sale in which the purchaser paid an advance of 25 per cent. for quick delivery. The foreign trade keeps up well, but owing to the improved domestic demand the foreign orders constitute a smaller percentage of the total trade than formerly. The changed situation puts the manufacturers in an interesting dilemma, whether to give the preference to the domestic or foreign buyer. They naturally prefer to favor the home demand, especially in view of the fact that at present prices home trade is the more profitable, but recognize that the foreign customer must be humored if the present grip is to be kept on his trade, which has served too useful a purpose in the immediate past to justify its neglect now.

Prentiss Bros. will build an extension. An interesting feature of their work of late has been the furnishing of nineteen outfits for boring the engine cylinders of French gasoline horseless carriages. The makers send drawings and rough castings, and Prentiss Bros. design and supply the entire outfit—machines, jigs and cutting tools. The requirements are very exacting, the holes being lapped to fit hardened plug gages. A curious feature is that while the drawings are of course figured in metric dimensions, Prentiss Bros. are usually instructed to buy the actual gages of American makers and to make the tools to suit them. The castings supplied from France are uniformly remarkable, both in quality of iron and in perfection of molding and coring. Of the outfits so far furnished, each one, with few exceptions, has gone to a different maker—a fact which forcibly illustrates the extent of the automobile industry in France.

PITTSBURGH REPORT.

Higher prices are ruling in nearly every branch of the iron and steel market, and the outlook is most promising for further advance. Not for some years past has the Pittsburgh market seen such a sharp advance and one which promises to be of a permanent character. Bessemer iron, which has been ruling from $10.65 as the minimum to $11.25 maximum figures, is now selling at $12.65 at Pittsburgh, with excellent prospects of another higher rate. In conversation with one of the leading iron and steel manufacturers of Pittsburgh, and in fact one of the largest in the country, he stated that by July next the Valley furnaces (now controlling the Pittsburgh raw iron market) will be selling $14 iron. At the present writing the prediction has every indication of fulfillment. This means an extremely higher rate for billets, which are now being sold for $20. A 500-ton sale is reported in Pittsburgh at the $21 rate, delivery three months. The purchaser wanted just twice that amount but could not get them. This looks very much as if prices would rule somewhat higher than those now being quoted.

Several of the boiler concerns have announced higher prices, but it is thought that owing to the overstock of boilers now on the market it will be another thing to get these asked-for rates. In the boiler line there have been several large-sized contracts awarded, and there are still quite a few to be given out. It is generally understood that Heine boilers will be installed at Schoenberger's new

(*Continued on page 40.*)

Miscellaneous Wants.

Advertisements will be inserted under this heat at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting, Grant; see p. 18.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co., Meriden, Ct.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

For Sale—Simplest boiler-cleaning patent; new device. B. K. Rankin, Nashville, Tenn.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," price $1, post paid. J.L.Lucas, Prov., R.I. Send for index sheet.

"Brandt's Triple Expansion Gaskets" are the best for boilers. Randolph Brandt, 38 Cortlandt st., New York.

Watch and clock tools, small automatic machines built to order; punches and dies. Waltham Machine Works, Waltham, Mass.

For Sale—One 30-inch Shellenbach pulley lathe, made by Henley Machine Tool Works; in very best condition. Curtis & Co. Mfg. Co., St. Louis, Mo.

Wanted—Machinist to manufacture gasoline engine, light weight, 2 horse-power; works perfectly for motor tricycles. Box 130, AMERICAN MACHINIST.

Threads and gears; easy rules to cut any thread possible to be cut in the lathe, without algebra, sent to any address for 25c. by G. W. Dixon, Spring Lake, Mich.

Wanted—Engine lathe, 5 ft. by 15 in., or larger; crank shaper, 15 to 18 in. stroke; state make, how long used, cash price and full particulars. Treher & Knott Bros., Gloversville, N. Y.

Institutions retiring from business having machine tools, brass or wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

We are prepared to do all kinds of mechanical drawing; inventions developed; capitalists and others desiring their ideas put on paper will do well to investigate; engineering problems, schemes and correspondence solicited. Box 120, AMER. MACHINIST.

For Sale or Rent—Foundry and machine shop with additional land, in good condition and well equipped for medium heavy work; capacity of foundry 7 tons per day; located on railroad within eight miles of New York; terms easy. Call or address J. F. Sweasy, 26 Nassau street, New York.

Wants.

Situations and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisement under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Experienced draftsman desires to change. Box 125, AMERICAN MACHINIST.

Draftsman; expert engine, general machine works; N. Y. or vicinity. Box 126, A. MACH.

Experienced draftsman and designer, technical graduate. Box 107, AMERICAN MACHINIST.

Foundry foreman wishes position; experienced, heavy or medium castings. Box 73, AMERICAN MACHINIST.

An experienced foreman on engines and general machine-shop work desires position. Box 123, AMERICAN MACHINIST.

First-class mechanical draftsman desires position; 15 years' shop and office experience. Box 119, AMERICAN MACHINIST.

Mechanical engineer, having good technical and business training, desires position with horseless-carriage concern. Box 129, A. MACH.

Draftsman and mechanical engineer, 20 years' varied exp., prac. designer of high-grade engines, tools, etc., desires situation. Box 29, AMERICAN MACHINIST.

Situation anywhere wanted by first-class general machinist and tool maker, with 19 years' exp.; best of references; age 36. German. Box 131, AMERICAN MACHINIST.

Wanted—Position as assistant superintendent, by one familiar with the latest methods of doing work rapidly and well; reliable; references. Address Box 118, AMER. MACH.

An engineer and business man, 20 years experience, desires a position as engine or machinery salesman; large acquaintance amongst manufacturers. Box 128, AM. MACHINIST.

Foreman pattern maker desires change; experienced in jobbing, general machine, or plumbers' sanitary ware and fittings, wood and metal; reference. Box 127, AM. MACH.

Wanted—By an engineer and manufacturer in general engineering work, a position as manager of works; or would like to join a new enterprise of engineering and founding; can introduce desirable lines of specialties; has extensive experience in all departments. Address "Originator," AMERICAN MACHINIST.

Help Wanted.

Wanted—Four first-class tool-makers, also five first-class pattern makers. Bullock Electric Mfg. Co., Cincinnati, Ohio.

Wanted—First-class salesman for slow and medium-speed Corliss engines, by a leading engine concern. Apply by letter to Box 121, AMERICAN MACHINIST.

Wanted—An experienced man, capable of installing and successfully operating a galvanizing plant; must be well recommended. Box 133, AMERICAN MACHINIST.

Wanted—Man of experience, capable of superintending machine and foundry plant of 200 men; give references and state experience, age, nationality and salary expected. Box 122, AMERICAN MACHINIST.

A capable machinist who can give security for few hundred dollars, can obtain established jobbing machine business in New York; easy terms; pay for plant from earnings. Box 124, AMERICAN MACHINIST.

Wanted—A man of experience to do estimating and lay out gear work of all descriptions in a Boston (Mass.) job gear-cutting shop; give full information and references. Address "Gear," AMERICAN MACHINIST.

Business Opportunity—A practical young man wanted to invest in one-half interest in an old-established manufacturing house; object, aid in managing and sales; good salary; best of references. Address, with references, "Business Opportunity," AMER. MACHINIST.

Wanted—Assistant foreman for machine shop; active young man who is familiar with modern machine-shop methods, and who has had experience in engine building and repairing. Apply by mail, stating age, nationality and past experience, The Atlantic Works, East Boston, Mass.

Wanted—For large machine works in Holland, A1 draftsman, familiar with constructing hydraulic and electric elevators and hoisting machinery; good position for the right person, with prospects of taking charge of drawing office; state experience and salary wanted. Box 113, AMERICAN MACHINIST.

Wanted—An up-to-date, experienced foreman for shop manufacturing engine lathes; must thoroughly understand rapid production on this class of work; state experience and wages wanted; steady employment for right man in small New England town; correspondence confidential. Box 100, AMER. MACH.

(*Continued from page 39.*)

rod mill at Pittsburgh. The boilers for the Pressed Steel Car Company have not, it is believed, been contracted for as yet. This company has given the Riter-Conley Manufacturing Company the contract for erecting the buildings.

Probably the most interesting bit of news given out for publication for some time was the statement that the Carnegie Steel Company had abandoned the project of building steel cars, and had made a contract with the Pressed Steel Car Company to stay out of that field of industry for five years, the Pressed Steel Car Company agreeing, in return, to purchase all the axles, plates, etc., necessary in the construction of these cars, amounting to between 900 and 1,000 tons daily, from the Carnegie Company. It is probably known that the Carnegie firm had staked off the ground for the contemplated buildings for car manufacturing interests and had gone into many details concerning the industry.

The E. P. Allis Company, through J. Weidman Murray, the firm's Pittsburgh representative, has been receiving very much of the engine business in this locality for some time. It has lately received contracts from the Schoenberger Steel Company, Carnegie Steel Company and others for its well-known blowing engines.

In other lines business has been brisk. W. J. Brant, of this city, who is handling the Playford stoker and the Stewart heater, has contracted to put in the Playford stoker at the new Ford Plate Glass Works, Toledo, Ohio, amounting in all to about 12,000 horse-power. He has also received contracts for several Stewart heaters, aggregating nearly 7,500 horse-power.

Quotations.

NEW YORK, Monday, Feb. 27.

Iron—American pig, tidewater delivery:—

Pennsylvania irons:	
No. 1 foundry	$13 25 @ 13 50
No. 2 foundry	12 75 @ 13 00
No. 2 plain	12 25 @ 12 50
Gray forge	12 00 @ 12 25
Southern irons:	
No. 1 foundry	13 50 @ 13 75
No. 2 foundry	13 25 @ 13 50
No. 3 foundry	12 75 @ 13 00
No. 1 soft	13 50 @ 13 75
No. 2 soft	13 25 @ 13 50
Foundry forge	12 50 @ 12 75

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.25 @ 1.30c.; refined, 1.30 @ 1.35c. Store prices: Common, 1.40 @ 1.50c.; refined, 1.50 @ 1.60c.

Tool Steel—Base Sizes—Standard quality 6 @ 7c., with lower prices on some brands extra grades, 12 @ 14c.; special grades, 16c. and upward.

Machinery Steel—Ordinary brands, from store, in small lots, 1.60 @ 1.70c.

Cold Rolled Steel Shafting—Base, sizes, from store in small lots, 2.30 @ 2.40c. upward.

Copper—Carload lots, Lake Superior ingot, 18c.; electrolytic, 17½ @ 17¾c.; casting copper, 17¼ @ 17½c.

Pig Lead—Carload lots, 4.37½ @ 4.42½c., f. o. b. New York.

Pig Tin—For 5 and 10 ton lots, 24¼ @ 24⅝c., f. o. b. New York.

Spelter—In carload lots, 6½c., New York delivery.

Antimony—In cask lots and over, 10 @ 11c., according to brand and quantity.

Lard Oil—Prime city, present make, the leding brand, 46 @ 47c., in wholesale lots; some brands 1 or 2 cents less.

Manufacturers.

Willis Clifford will erect a plant near Pittsburgh, Pa., for the manufacture of the Capell mine fan.

Contractor J. E. Bennett has begun work on the new foundry and machine shops at Waycross, Ga.

(*Continued on page 41.*)

Export to Austria.

First rate firm of engineers, Vienna, doing extensive business with official and private establishments, wants to represent large concerns manufacturing motors, machines, tools, electrical supplies, etc.

BOX 132, AMERICAN MACHINIST.

TO RENT.

Prominent Machinery house, near Broadway and Cortlandt St., will rent half of salesroom 22 x 75 to kindred line. Attractively fitted. Power in building.

Address, CORTLANDT,
Care of *American Machinist.*

Agency for France.

A well known French Engineer would like to represent American Machine Tools and Electric Machines for light and motors in France, and therefore would enter in business transactions with one or several large concerns of this kind having large orders already on hand from French firms.

FRENCH, Box 117, American Machinist.

CLEVELAND GEAR WORKS

86 Seneca Street,
CLEVELAND, OHIO.
W. R. SAWYER, Lessee.

Gear Wheels and Gear Cutting

Of all descriptions.

Get Our Prices.

THE WARDEN OIL FILTER

is guaranteed to reduce your oil bills at least 50%. Ask your supply house or oil company to send you one on trial. Used by prominent firms throughout the world.

Business Established 9 Years.

THE BURT MFG. CO.
AKRON, OHIO, U. S. A.

Largest Manufacturers of Oil Filters in the World.

Don't Stay

in the same subordinate position all your life. You can obtain a better position and higher pay by devoting some of your spare time at home to study at a cost so low that you will not feel the outlay. Courses by mail in **MECHANICAL, STEAM AND ELECTRICAL ENGINEERING, MECHANICAL DRAWING AND MACHINE DESIGN. BEST TEXT BOOKS AND DRAWING PLATES FREE.** Seven years of experience in teaching by correspondence has made our courses the **best, most thorough** and **practical.** Write for our illustrated circular T, sample pages of text books, drawing plate, and booklet of letters from students all over the world.

The United Correspondence Schools,
154, 156, 158 Fifth Ave., New York.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.
HARTFORD, CONN.

J. M. ALLEN, President.
WM. B. FRANKLIN, Vice-President.
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J. B. PIERCE, Secretary.
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FOR SALE AT A BARGAIN

The following second-hand foundry equipment:

1 Colliau Cupola, melting capacity four tons per hour; in first-class condition.
1 Colliau Cupola, melting capacity six tons per hour; in fair condition.
1 No. 8 Sturtevant Blower in good condition.
1 No. 10 Sturtevant Blower in good condition.
5 36″ x 53″ double geared cast iron Rumblers.
1 26″ x 43″ single geared cast iron Rumbler.

All can be seen at our works.

GENERAL ELECTRIC CO.
SCHENECTADY, N. Y.

EVANS FRICTION CONE PULLEYS.

Hanging and Standing CONES.

Made in all sizes. Thousands in use, transmitting from 1 to 40 H. P. For information address G. F. Evans, Proprietor.

No. 85 Water Street, Boston, Mass.

C. W. Burton, Griffiths & Co., Agents, London, England.

REG. TRADE MARKS

THE PHOSPHOR BRONZE SMELTING CO. LIMITED,
2200 WASHINGTON AVE., PHILADELPHIA.
"ELEPHANT BRAND PHOSPHOR-BRONZE"
INGOTS, CASTINGS, WIRE, RODS, SHEETS, ETC.
— DELTA METAL —
CASTINGS, STAMPINGS AND FORGINGS
ORIGINAL AND SOLE MAKERS IN THE U.S.

SEND FOR CATALOGUE.
WORCESTER MACHINE SCREW CO.

MANUFACTURERS OF
Set, Cap and Machine Screws, Studs, &c.

Special Screws and Studs.
Sheet Metal Stamping.
Hardware Specialties.

SITTMAN & PITT,
STATE STREET AND BOERUM PLACE, BROOKLYN, N. Y.

18-inch Hendey-Norton Lathe.

ALL these Lathes have the Norton Screw Cutting feature. All the different threads and feeds in daily use obtained by moving the handle in gear box from one notch to the other. All sizes but the 32 in. fitted with our Automatic Stop Rod for carriage. By its use you can cut threads to and from shoulders and always have the carriage stop in the same place. All lathes have the reverse motion in head, operated by lever at side of apron. By this you reverse the carriage only, which is all that is necessary in cutting threads.

These attachments mean a great saving of time and labor.

The Hendey Machine Co.

Torrington, Conn.

Agents for the Pacific Coast:
Pacific Tool & Supply Co., San Francisco, Cal.
J. W. Cregar, Philadelphia Bourse Exhibition.
European Agents:
Schuchardt & Schutte, Berlin Vienna, Brussels.
Chas. Churchill & Co., Ltd., London and Birmingham, Eng.
Adolphe Janssens, Paris, France.

(*Continued from page* 40.)

Smith, Kline & French Company intend erecting additions and making repairs to their factory building, which was recently destroyed by fire, at Poplar and Canal streets, Philadelphia, Pa.

The Wolverine Manufacturing Company has purchased fifteen lots on Thirteenth street, Duluth, Minn. They will immediately begin to build an addition, and expect to give employment to 100 extra hands.

The Godcharles Nail Company has decided to rebuilt its plant, which was recently destroyed by fire, at Milton, Pa. The firm has also purchased the Lewisburg nail works and will add the same to their plant at Milton.

Contractors John Davies & Son have been awarded the contract to erect the two-story brick mill and boiler house, 44 by 117.8 feet, at the southwest corner of Margaretta and Ditman streets, Frankford, Pa., for E. Holden & Co.

The contract for the erection of the four-story brick factory, 60x164 feet, at Sixth street and Glenwood avenue, Philadelphia, Pa., has been awarded to Contractor John R. Wiggins. The building will be erected for the Scott Paper Company.

The Fred W. Wolf Company, architects, of Chicago, have prepared plans for a factory for the Oakland Sugar Mill Company. There will be a group of buildings of different sizes, the main structure to be three stories high, besides basement, and 221x64 feet, of fireproof construction. The estimated cost of the plant is $500,000.

Contractor Dougherty is taking bids for the erection and completion of an arcade store and glass factory, on the board walk, near Pennsylvania avenue, Atlantic City, N. J., for the Bohemian Art Glass Company. Thomas Stephen, of Camden, is the architect. The building will be two stories high, of steel construction, with metal awning, and will measure 80 by 100 feet.

Plans for the Edwin Armitage Manufacturing Company's buildings at Royal Oak, Mich., have been completed by John M. Case, architect. The main building is to be 50x180 feet, three and four stories high. Next to this is a boiler and engine-house annex, 60x30 feet, and beyond this, but connected with the main building by a covered passageway, is a structure 60x40 feet, and two stories high, intended for the color department.

Armour & Co. propose to expend $750,000 in the erection of a mammoth power-house on Packers avenue, between Forty-third and Forty-fourth streets, Chicago, Ill. The company will concentrate its power business there, using steam and distributing by means of electricity. In the present power plants there are thirty-six engines. The building will be 200x200 feet, one story, and with a hight of 60 to 70 feet, galleries and other accommodations being placed where necessary.

The Acheson Graphite Company has been incorporated under the laws of New Jersey, with a capital stock of $1,000,000, to manufacture graphite and pure carbon. The plant will be located on the property of the Niagara Falls Power Company at Niagara Falls. At a meeting of the stockholders directors were elected as follows: E. G. Acheson, Charles H. Huntley, J. F. Wilson, Buffalo, N. Y.; A. W. Mellon, Pittsburgh, Pa.; K. K. McLaren, Jersey City, N. J. The directors elected E. G. Acheson president; Charles H. Huntley, vice-president and treasurer, and P. McN. Bennie, secretary. The objects of the company are stated to be the manufacture of graphite and carbon for paints, for foundry facings, for electrotyping and for other purposes; also to manufacture, sell, deal in and deal with graphite paints, stove polish, crucibles and other forms of graphite and carbon articles.

New Catalogs.

We have received from B. F. Sturtevant Company, Boston, Mass., Bulletin G, in which are described generating sets with automatic horizontal and upright engines. The bulletin is 7¾x10½ inches.

We are in receipt of catalog of the American Arithmometer Company, of St. Louis, Mo. A list of establishments in which this adding machine is in use is given and also a number of testimonial letters. The catalog is 5x7 inches.

From the Chisholm & Moore Manufacturing Company, Cleveland, Ohio, we have received catalog of electric, air and chain hoists, cranes and trolleys. Moore's anti-friction chain pulley block is minutely described. The catalog is standard size, 6x9 inches.

We have received from Loring, Coes & Co., Worcester, Mass., a very attractive catalog giving some facts concerning the tempering of wood-working machine knives, paper knives, book-binders' hand shears and milling cutters. The catalog is standard size, 6x9 inches.

The New Process Twist Drill Company, Taunton, Mass., sends us 1899 catalog of twist drills, reamers and other tools of a kindred character. Some useful tables of drill speeds, decimal equivalents, etc., are presented in the catalog, which is standard size, 6x9 inches.

We have received catalog of R. Conrader, Erie, Pa., in which is illustrated and described the Only Oil Filter. Both perspective and sectional views of this filter are shown. Its construction and method of operation are very fully described. The catalog contains a number of testimonial letters, and is standard size, 3½x6 inches.

From the Buffalo Forge Company, Buffalo, N. Y., we have received "B" '98 engine folder, showing the Buffalo automatic engines, horizontal and vertical. The folder is 3½x6½ inches. From the same company we have also received small catalog illustrating and describing down draft forges. These forges are adapted to all classes of smith work.

The Ingersoll-Sergeant Drill Company, New York, has sent us copy of catalog No. 41, illustrating and describing rock drills, gadders, air compressors and other machinery used in mining, tunneling and quarrying. The catalog is profusely illustrated, showing the various places in which the machinery can be used. It contains 104 pages, and is standard size, 6x9 inches.

We have received from Chas. P. Willard & Co., Chicago, 1899 catalog of marine engines and boilers, steam and electro-vapor yachts and launches. Illustrations of various types of marine engines and launches are given. The Willard water-tube marine boiler is illustrated and described. The catalog ought to interest all interested in marine engineering, and is 6x9¼ inches.

The Globe Company, Cincinnati, sends us catalog No. 26 of filing cabinets and business furniture, including book cabinets, letter files, card index cabinets, etc. The card index has found and continues to find an increasing use in manufacturing establishments and some of its advantages are described in the catalog referred to. The catalog contains 165 pages, and is standard size, 6x9 inches.

We have received general catalog No. 114 of the Atlas Engine Works, Indianapolis, Ind., printed in Spanish, the work of translation having been done by our contributor, Mr. Juan de Tejada. The capacities of the various engines are given in tabular form. Boilers of various types, including multi-tubular and locomotive, are also shown. Altogether the catalog is very comprehensive, and is standard size, 6x9 inches.

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76,800 DAILY PRODUCTION.

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An abstract of our "Treatise on Files" which since its publication in 1878, has been the accepted authority on the subject of Files all over the World.

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JOHN WILEY & SONS, 53 E. Tenth Street, NEW YORK CITY.

We Claim the Following Merits for ..... Jenkins Bros.' Valves.

1. Manufactured of the best Steam Metal.
2. No regrinding, therefore not constantly wearing out the Seat of the Valves.
3. Contains JENKINS DISC, which is suitable for all Pressures of Steam, Oil and Acids.
4. The Easiest Repaired, and all parts Interchangeable.
5. Every Valve Tested before leaving the factory.
6. ALL GENUINE stamped with Trade Mark.

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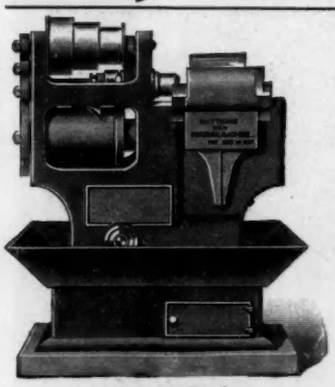

Automatic Duplex.

The New Forming Machine.

This Cut represents the

Automatic Duplex.

Capacity, 3-16 inch to 2 inches diameter, 1-16 inch to 8 inches length. Executes work without the slightest danger of breakage, so slender that it cannot be done by any other method. With the addition of Turret it is a rapid and accurate Screw Machine.

Every machine thoroughly tested before shipping.

Pedal Pins, Balls, Ball Cranks, Axles, Rollers, Studs, Tapers, Knurls, and all screw machine work, covering a field which is approached by no other machine made.

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Jas. D. Mattison,

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Our Annealed Die and Tool Steel

Saves Time, Labor, Money.

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